Business model innovation within the Norwegian energy sector

A comparative case study of business model innovation applied by ABB and DNVGL to adapt to the energy change in Norway

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Abstract

The trend of energy change affects the Norwegian energy sector. Due to the relatively nascent and rapid advancing nature of the industry, BMI in the energy sector is a new domain that has not been explored much in the literature. This thesis explores how suppliers in the Norwegian energy sector respond and adapt to the context change by innovating their business models. Through a qualitative case study with an explorative and comparative design, the author compared the case of ABB and DNVGL and demonstrated the different BMI approaches that are applied by firms in the sector.

The findings indicate that technology is both the core competence for the firm as well as the dominant factor for BMI. The success of technology commercialization is based on a good value proposition and BMI, but if the technology is unique as an outstanding offering of the business model, it may lighten the importance of BMI, and will dominate the BMI. Except the technology factor, the BMI differs based on the firm's culture and cognition. A different degree of flexibility in the extent of implementing BMI between product-based firm and service-centred firm is due to firm's value creation difference and essentially due to the firm's culture and cognition difference. The results indicate that the BMI in the product-based firm is more likely to be influenced by the end user, but the BMI in the service-centred firm is more likely to influence the end user. It would be interesting to conduct more interviews across a number of suppliers who vary in size, resources and brand popularity to determine how the BMI will be impacted by these factors, and to highlight the main difference between product-based firm and service-centred firm in applying BMI.

List of illustrations

Figure 1 Energy generation utilities' value chain (Richter, 2013) 2
Figure 2 Energy utilities value network 3
Figure 3 Energy value chain change led by smart grid technology innovation (Panfil et al., 2009) 6
Figure 4 Business model pillars based on Osterwalder et al. (2005) and Kijl et al. (2005) 10
Figure 5 Shift to service-driven BMI (Foss and Saebi, 2015) 12
Figure 6 Value Chain (Porter 1985) 15
Figure 7 A dynamic business model framework (Kijl et al., 2005) 18
Figure 8 Conceptual framework for inductive case study by Eisenhardt (1989) 21
Figure 9 Methodology of data coding and data analysis (Osterwalder et al., 2005, Kijl et al., 2005) 27
Figure 10 The role of ABB and DNVGL in the dynamic Norwegian energy sector 28
Figure 11 ABB's innovative offering for improving renewable energy and energy efficiency 34
Figure 12 DNVGL's three main value proposition 36
Figure 13 DNVGL's innovating offering for improving renewable energy and energy efficiency 36
Figure 14 Beyond old silos: Subsector arbitrage (Jones, 2015) 37
Figure 15 ABB's product-based cost structure in realizing the revenue stream 45
Figure 16 Summaries the overall picture of the energy system in the EU (European Environment Agency, 2013b) 57
Figure 17 Summary of energy support schemes in the Norwegian energy sector (European Environment Agency, 2013a) 59

List of tables

Table 1 Abbreviation overview VII
Table 2 Business model pillars and nine building blocks (Osterwalder et al., 2005) (Osterwalder and Pigneur, 2010) 11
Table 3 Introduction of analysis units 21
Table 4 Primary data collection 23
Table 5 Dynamic context change and the general innovation applied by ABB & DNVGL reacting to the change 33
Table 6 Offering analysis 37
Table 7 Customer interface analysis 42
Table 8 Infrastructure management analysis 44
Table 9 Financial aspects analysis 46
Table 10 Analysis categories and interview questions 56

Abbreviations

Table 1 Abbreviation overview

Abbreviations	Notion
BM	Business Model
BMI	Business Model Innovation
BMC	Business Model Configuration
VC	Value Chain
VS	Value Shop
VN	Value Network
EEA	European Economic Area
EU	European Union
EV	Electric Vehicle
HV	High Voltage
HVDC	High Voltage Direct Current
BU	Business Unit

Contents

Acknowledgements ..... **III**

Abstract ..... **IV**

List of illustrations ..... **V**

List of tables ..... **VI**

Abbreviations ..... **VII**

1 Introduction **1**
- **1.1 Why a study on BMI within the Norwegian energy sector?** **1**
- **1.2 Suppliers and the energy sector value network** **2**
- **1.3 Norwegian energy policy and the action plan** **3**
- **1.4 Changes in Norwegian energy sector scenario in the study timelines** **5**
- **1.5 Rationale of the research** **7**
- **1.6 Research question** **8**
- **1.7 Objectives of the study** **8**
- **1.8 Layout of the study** **8**

2 Theory framework and literature review **9**
- **2.1 Business Model Framework** **9**
  - 2.1.1 Business model 9
  - 2.1.2 Business model configuration 9
  - 2.1.3 A cognitive perspective of BMI 13
  - 2.1.4 A dynamic context perspective of BMI 13
  - 2.1.5 BMI in the energy sector 14
- **2.2 Value Creation Framework** **14**
  - 2.2.1 Value chain and its elements 15
  - 2.2.2 From value chain to value shop and value network 16
  - 2.2.3 Firm's culture and cognition based on value creation logic 16
- **2.3 Dynamic Business Model** **17**

3 Research Methodology **20**
- **3.1 Research design** **20**
- **3.2 Conceptual framework** **21**
- **3.3 Introduction of analysis units** **21**
- **3.4 Data Collection** **22**
  - 3.4.1 Primary Data 22
  - 3.4.2 Secondary Data 23
  - 3.4.3 Data Reliability 23
  - 3.4.4 Data Validity 24
- **3.5 Question design and interviewee selection** **25**
- **3.6 Data Coding and Analysing** **26**

4 Results Analysis **28**
- **4.1 Analysis units in the dynamic context** **28**
  - 4.1.1 The government energy target and action on generation, distribution and consumption 28
  - 4.1.2 How do leading suppliers adjust to the changing environment? 31

4.2 Offering ... 34
4.3 Customer interface ... 39
4.4 Infrastructure management ... 42
4.5 Financial aspects ... 45

5 Discussion and conclusion ... 47

References ... 53

Appendix 1: Interview Questions ... 56

Appendix 2: Summaries the overall picture of the energy system in the EU ... 57

Appendix 3: Summary of energy support schemes in the Norwegian energy sector ... 58

1 Introduction

1.1 Why a study on BMI within the Norwegian energy sector?

This thesis explores the question of how suppliers in the Norwegian energy sector respond and adapt to context changes by innovating their business models. This overall topic is discussed in the particular context of Norwegian energy sector, and the study is implemented during the time that the energy change became a trend affecting the whole scenario and the public mind-set. A study on BMI in the Norwegian energy sector is chosen mainly based on the author's personal interest in the field, as well as the geographic proximity. With eight years of experiences working for suppliers of equipment and services in the energy sector, the author is fascinated by observing the dynamic abilities to the ever-changing conditions in the industry.

Firstly, Norway is rich in renewable energy resources especially in hydropower, the resource that used to generate 100% of electricity in Norway. However, this situation is changing because the government is strongly encouraging a more diversified energy utility in order to achieve the country energy target; Secondly, the Norwegian government is both changing its regulations for renewable energy, and creating funds for economic support for these companies. This creates a dynamic industry that needs to develop new business model to adapt to. This study wishes to uncover different methods of BMI that are stimulated by these governmental initiatives. Therefore, it is particularly interesting to discover the change in the Norwegian energy sector and to learn BMI applied by the analysis units reacting to the change.

Besides the professional perspectives, academic perspectives also motivate this study. From an academic standpoint, we know a lot about how organizations respond to change (e.g., (Duncan, 1972)), there is also research on how firms apply BMI (e.g., (Chesbrough, 2007)), however, very few studies have explored this particular issue in the energy change scenario. Zott et al. (2011) summarizes three main research trends in the literature on business models. The first big part is e-business or digital market, the second part is strategy and the last part is technology and innovation management. Recently, some literatures on renewable energy utility's BMI has drawn academic's attention (e.g., (Richter, 2013, Huijben and Verbong, 2013)). However BMI studies that target the industrial equipment and service suppliers in the energy sector have not yet been performed.

1.2 Suppliers and the energy sector value network

In order to clearly present the study objective, the notions 'suppliers' and 'utilities' in the energy sector should be clarified and differentiated.

In this study, the 'suppliers' are the firms who sell equipment, engineering, or service to the energy generation utilities. Also included are those who sell to the firms on the utilities' value chain that distribute and consume energy.

The 'utilities' represent energy-generating firms. In the Norwegian energy sector, these energy-generating firms are electric power generation companies based on all kinds of renewable energy, such as hydropower, solar energy, biomass, and wind power etc. The biggest renewable energy producer is a state owned company Statkraft, which has more than 230 hydro power plants, and a few wind power plants in Norway. The electricity distribution-electric network is operated and managed by another state owned company Statnett[1]. There are three main parts of the electricity consumption: industry customer, transportation and residential. The energy generation utilities' value chain is simply illustrated with the five segments below (Richter, 2013):

Figure 1 Energy generation utilities' value chain (Richter, 2013)

A value network diagram is illustrated below, based on the energy generation utilities' value chain and the energy sector context, as well as the main players in the context.

[1] Statnett is the Norwegian state owned enterprise directed through the Ministry of Petroleum and Energy. It is the national power system operator, which operates about 11000km of HV power lines and 150 power stations all over Norway. It is also responsible for the connections to Sweden, Finland, Russia, Denmark and the Netherlands.

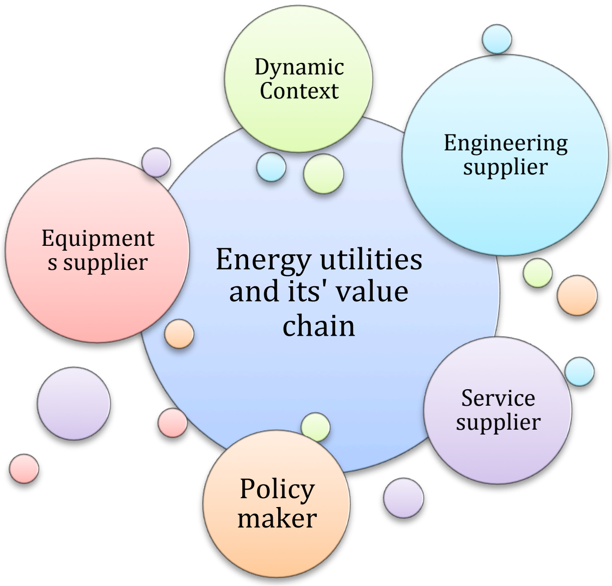

Figure 2 Energy utilities value network

The two cases in this study are ABB and DNVGL. ABB is mainly a product-based firm that supplies physical products and engineering services. DNVGL is a service-centred firm that offers consultancy, licencing and assurance services. Together these companies cover the whole value chain, and both of them are leaders in their respective segment.

1.3 Norwegian energy policy and the action plan

Norway is not a member of the EU and, as such, Norway does not have any targets under ESD (effort sharing decision). However, as a member of the EEA (European economic area), the Norwegian energy policy has to conform to the EEA's general energy strategy and implement the combined political energy target. Furthermore, another dominant climate and energy policy that Norway follows is the Kyoto protocol. The Kyoto protocol is an international agreement that extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC). The Kyoto protocol summons 120 parties/countries worldwide to draft a treaty in order to control the manmade CO2 emissions, the global greenhouse effect, and climate change issues. According to the Kyoto protocol, Norway is one of the Annex B parties with binding targets for greenhouse gas emission from 2012-2020 set in the second-round of Kyoto protocol (Wikipedia, 2015, Ministry of Petroleum and Energy, 2013, Norwegian ministry of the environment, 2009). Norway adopted the Renewable Energy Directive (2009/28/EC) as part of the EEA, and the set target for Norway is to reach a share of 67.5% renewable energy in the gross final energy consumption (FEC) in 2020 (European Environment Agency, 2013a).

In the new white paper presented by the Norwegian government in 2012, a new political climate agreement was made. I.e. the CO2 tax for the petroleum sector on the Norwegian Continental Shelf was raised by NOK200 per ton from 1 January 2013. Meanwhile, a new fund for climate change mitigation, renewable energy and energy renovation is created, in order to supplement the basic fund for renewable energy and energy efficiency (European Environment Agency, 2013a). Furthermore, a new government support schemes on energy tax exemption are implemented for stimulating and supporting the renewable energy and energy efficiency (Appendix 3).

The Norwegian energy sector has evolved greatly before and during the timespan of this research. An incremental change is the following on-going worldwide trend towards renewable energy and energy efficiency—as required by the Kyoto protocol and EEA energy and climate target. Based on the country energy report from ABB and the EEA, there are three main trends within the Norwegian energy sector (European Environment Agency, 2013a):

Trend 1: Energy efficiency: A demand on energy efficiency and low carbon emission, the energy that is saved is considered ‘green’.

Trend 2: Energy intensity: A demand on energy storage capacity and energy security.

Trend 3: Energy consumption: A requirement on reducing energy consumption per capita.

Influenced by these trends, the Norwegian government initiated an action plan in order to reach the target as part of EEA and to realize the agreement of Kyoto protocol (European Environment Agency, 2013a). The action plan comprises three main directions:

Action 1: Promote the energy efficiency[2],

Action 2: Encourage the renewable energy,

Action 3: Develop the energy and climate technologies.

[2] Energy efficiency is a term that is widespread in global energy sustainability and has been appraised by the International Energy Agency (IEA) as “the greatest potential” to save energy and reduce greenhouse gas emissions. SHAH, V. 2015. *5 ways energy efficiency is changing the world* [Online]. Eco-Business. Available: http://www.eco-business.com/news/5-ways-energy-efficiency-is-changing-the-world/ [Accessed 8 August 2015].

1.4 Changes in Norwegian energy sector scenario in the study timelines

According to Kijl et al. (2005), many firms as well as incumbents often fail to monitor and act on economic macro trends that may indicate opportunities or threats. It is undoubtedly important to analyse the macro environment. Kijl et al. (2005) points out that in the context of business model analysis, the technological developments and regulations have direct impact on business models.

Change is defined as an "act or process through which something becomes different" (Oxford Dictionaries, 2015). In academic study, the word 'change' is divided into two levels according to a popular classification dichotomy—the radical versus the incremental change. Kijl et al. (2005) explains that from a technological capabilities view, technological change can be seen as competence heightening or incremental if the capabilities (e.g. skills, knowledge, assets, and resources) needed to exploit a new technology are built on the firms' existing capabilities.

This research timeline spans from February 2015 to August 2015. The macro economy observes an incremental change that is on going within the Norwegian energy sector. This is a current energy change following the Kyoto protocol and EEA energy and the climate target 2020.

Norway is a country with rich and diversified energy resources, and energy resources can be simply summed up of fossil energy and renewable energy. According to Energi Norge (2015): Norway has one per cent of Europe's population, but 20 per cent of the hydropower resources, 40 per cent of the gas resources and 60 per cent of the oil resources. The chart in the appendix 2 presents a summary of all kinds of energy resources and its consumption process in the EU for a better understanding about the energy sector. Norway does not have such broad energy resources but the energy consumption process is somehow similar. Norway is a unique country that is rich of hydropower and other kinds of renewable energies such as wind, thermal, wave, and tidal resources. According to Statistics Norway (2015), the Norwegian energy sector became well known to the world thanks to the oil resource and oil industry, but the truth is that more than 97% of the electricity production in Norway is based on renewable energy. This is interesting information for the general background of this study.

The energy change trend is worldwide and it dominates the main external dynamic context of the Norwegian energy sector. In the meantime, renewable technologies and technologies that improve energy efficiency have been significantly improved in recent years. One outstanding technology innovation is the smart grids[3] technology. According to the figure 3, the energy value chain will be led by the smart grid technology that not only integrates the energy transmission and distribution, but also upgrades the whole system regarding more energy efficiency and energy inclusive, as well as a more environmental friendly energy consumption value chain.

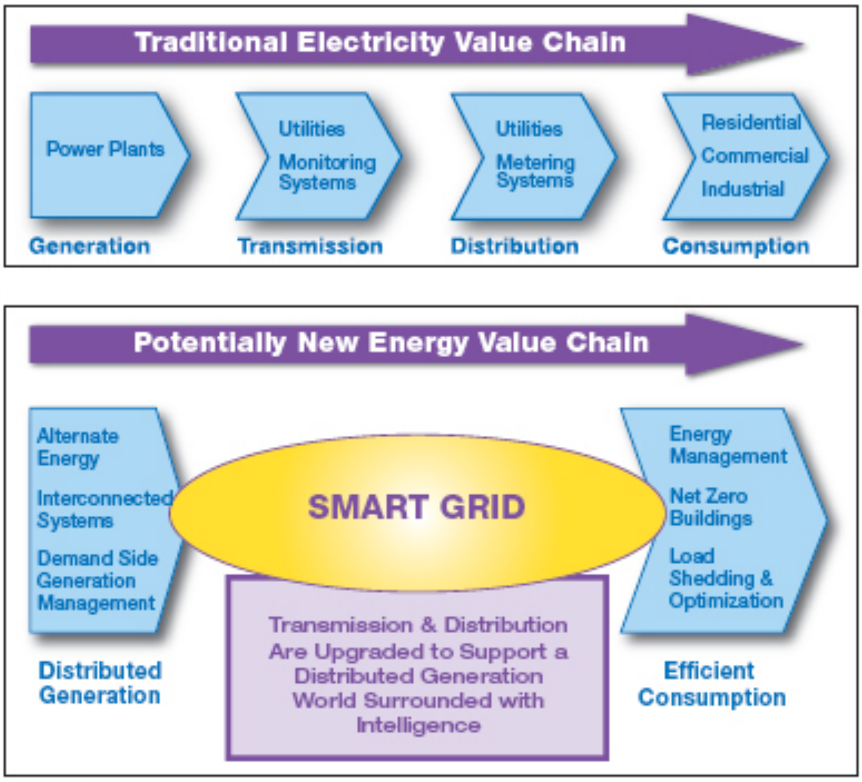

Figure 3 Energy value chain change led by smart grid technology innovation (Panfil et al., 2009)

As two leading incumbent suppliers in the energy sector in the change scenario, ABB and DNVGL have sensed the energy trend and have been developing technology and commercializing said technology with an innovated business model to adapt to the change. Since 2010, both ABB and DNVGL's internal media introduced the future energy system and their technological innovation related with it. ABB realizes the electricity supply is experiencing tremendous changes, as the power generation utilities shifts towards

[3] Smart Grids is defined by the European regulators' group for electricity and gas (ERGEG) as an power system that can efficiently integrate the behaviour and actions of all users connected to it—generators, transformer, distributer, consumers and those that do both—in order to ensure an economically efficient, sustainable electricity network with low losses and high levels of quality and security of supply and safety. ERGEG 2009. Position paper on smart grids. An ERGEG public consultation paper. ERGEG [European Regulators' Group for Electricity and Gas].

renewables, more feed-in nodes are increasing the complexity of the grid (ABB, 2014). With more than 1085 patents supporting this technological innovation, ABB is the top one smart grids pioneer company; and its innovation target is focused on not just grids, but smart cities with a better energy monitoring and easier usage for residential and business customers (White, 2015).

DNVGL is passionate and experienced in the energy industry research and renewable energy technology development. In the latest energy industry report by DNVGL, the renewable energy, energy efficiency, and decarbonized energy systems are discussed and considered as a world trend and as alternatives to fossil energy. DNVGL believes that the energy context will be more challenging to cope with for the firms in the energy sector compared to the past five years. However, the new reality brings both opportunities and challenges. It is a thrilling time to work in the electricity sector, and the energy industry at large. The energy system is changing, new technologies and existing systems need to be made to work together; environmental concerns are far more critical than they've been before; and electricity's role in underpinning and expanding prosperity is almost impossible to overemphasize (Jones, 2015).

1.5 Rationale of the research

The business model, especially the BMI is a new concept in the theory ground. The 'BMI' concept discussed in this study is "a process where a firm introduces changes into its business model in order to realign it to fit a new competitive landscape" (Casadesus-Masanell and Ricart, 2010, Foss and Saebi, 2015).

There are very few relevant studies with the perspective of BMI applied by equipment and service suppliers in the energy sector. Therefore, this research is designed as an explorative study; the data for analysing the research units are collected mainly from secondary research and direct interviews. The data collection and interpretation are following the methodology in order to guarantee the most reliable data and validity. Chapter 3 presents the detailed methodology, and the whole research follows the conceptual framework from Eisenhardt (1989) in order to carry out this case study and to realize the data implementation. Based on the conceptual framework, two cases are chosen due to the significant similarity in the nature of those two case objectives: Firstly, both companies are the market leaders cross industries, big in scale and well known in the market worldwide. Secondly, both of their core businesses comprise the energy segment, to which they supply equipment, engineering or services.

Not only the similarities between the two analysis units, but also the differences in the offering and the culture of these two firms fascinate the author to compare them in detail. Since each of them can represent a typical type of supplier in the energy sector, it can be very interesting to find out their respective response to the energy change by studying their BMI following this trend.

1.6 Research question

How do suppliers in the Norwegian energy sector employ BMI to adapt to the energy change?

In order to adequately carry out the explorative case study and answer this research question, the theories and literatures will covers three key elements:

- Business model
- Value creation
- Dynamic business model

1.7 Objectives of the study

Based on the research question, the following section lists the general objectives and specific objectives to achieve in the study:

General objectives:

- To analyse the BMI conducted by the analysis units.

Specific objectives:

- To assess the current business model and analyse its major elements.
- To examine the dynamic context change that affects the company and BMI.
- To evaluate and compare the value creation logic of the two analysis units.

1.8 Layout of the study

Chapter 2 presents the current literature and the theoretical frameworks to which the research question is related. The chapter describes and discusses the methodology applied in previous studies as well as the findings. The methodology of this qualitative case study is described in chapter 3, and the results of the analysis are presented in chapter 4. Discussion is addressed in light of analysis and relevant literature in chapter 5; the conclusion, limitation and implication of this study are drawn in the latter part of chapter 5.

2 Theory framework and literature review

The research question is based on BMI in the energy sector; therefore the business model and value creation logic are the basic theory to start with. Since no business runs in vacuum, the dynamic business model is important for the study. In a word, to employ the BMI within the firms, it is vital to base on the theory framework consists of business model, value creation logic and dynamic business model (Teece, 2010, Casadesus-Masanell and Ricart, 2010, Chesbrough, 2010).

2.1 Business Model Framework

2.1.1 Business model

The concept of a business model has become particularly influential, and the business model research and application has driven this notion into various streams.

From the research of Zott et al. (2011), the literature related with Business Model has been developed mainly in three silos: (a) e-business and the use of information technology in organizations; (b) strategic issues i.e. value creation, competitive advantage, and firm performance; and (c) technology innovation. In the recently published book BMI, Foss and Saebi (2015) correspondingly conclude the overall business model literature construct in the current academic research, amongst others (1) as a foundation for categorizing firms; (2) as an antecedent of distinguishing firm performances; and (3) as a new form of innovation.

The definition of a business model chosen for this study is the one given by Teece: The core of a business model is in defining the manner by which the enterprise delivers value to customers, attracts customers to pay for value, and alters the payments to profit (Teece, 2010).

2.1.2 Business model configuration

The business model framework contains both internal and external elements, among which are the core element offering, value creation and value capture (Foss and Saebi, 2015, Baden-Fuller and Morgan, 2010, Teece, 2010).

Over the years, the research in business model has become more matured. In the research literature and company practice, a business model is broken down into various parts for better understanding and implementation, two typical business model configuration research are:

Osterwalder and Pigneur (2010) suggest nine building blocks (Table 2); Foss and Saebi (2015) state a service-driven business model and draw a figure consist of five elements (Figure 5).

- **Four pillars and Nine building blocks**

Based on the study of Osterwalder et al. (2005) and Kijl et al. (2005), a business model consists of four pillars illustrated in Figure 4. Also included is the nine building blocks theory from the literature of Osterwalder and Pigneur (2010) and Osterwalder et al. (2005), because it gives an in-depth knowledge of business model configuration and a tool to measure BMI. Table 2 gives a clear explanation of each building block and the pillars it belongs to according to the study.

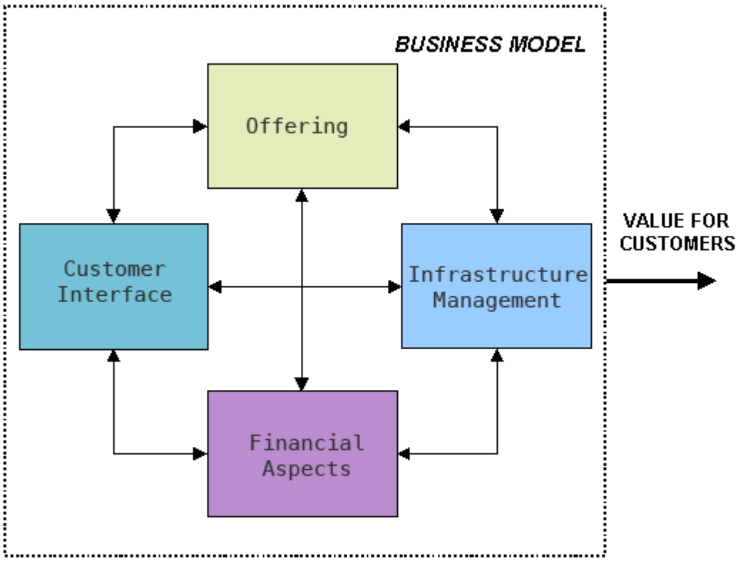

Figure 4 Business model pillars based on Osterwalder et al. (2005) and Kijl et al. (2005)

Table 2 Business model pillars and nine building blocks (Osterwalder et al., 2005) (Osterwalder and Pigneur, 2010)

Pillar	BM Building Blocks	Definition
Offering	Value Propositions	A general outlook of a company's offering to customers: products and/or services.
Customer Interface	Customer Segments	The target customer that a company wants to offer value to.
	Channels	The various means through which the company get in touch with its customers.
	Customer Relationships	The link between company and its different customer segments.
Infrastructure Management	Key Resources	The key competencies necessary to execute the company's business model and innovation.
	Key Activities	The arrangement of activities and resources.
	Key Partnerships	The network of cooperative agreements with other companies necessary to efficiently offer and commercialize value.
Financial Aspects	Revenue Streams	The way a company makes money through a variety of revenue flows.
	Cost Structure	Sums up the monetary consequences of the means employed in the business model.

- **From product-based business model to a service-centred business model**

Foss and Saebi (2015) draws a picture that carries two parts: (a) five fundamental BM elements, each linked to underlying resources and capabilities: offering, process, customer relationships, value network, and culture; (b) an innovation of business model driven from product oriented BM to service-centred BM (Figure 5).

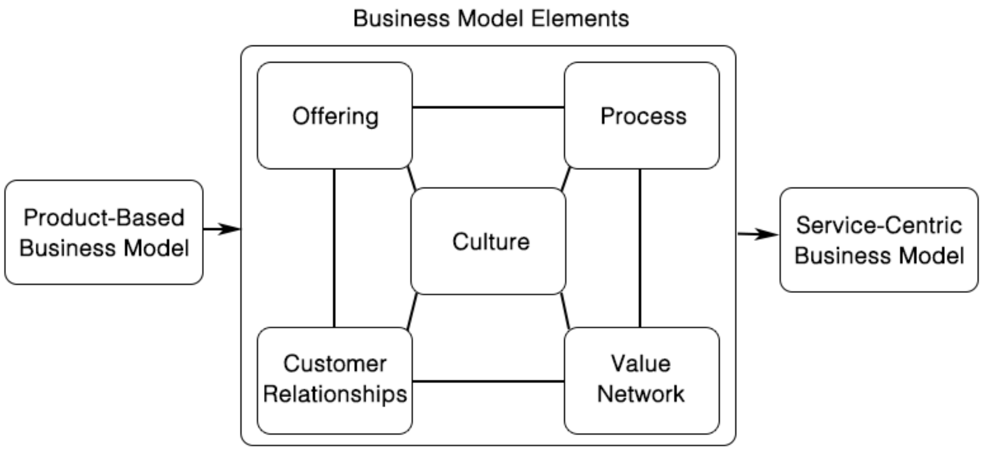

Figure 5 Shift to service-driven BMI (Foss and Saebi, 2015)

The elements such as 'offering' and 'customer relationships' ('Customer Interface') are similar to the study of Osterwalder et al. (2005) as explained in table 2. The different elements comprise:

Value network

The value chain cannot express the interconnections for the firm's business with the whole context, since firms are embedded in networks of interconnected relationships that form a net of relations. This value network extends far beyond the customer-supplier dyad value chain (Foss and Saebi, 2015). The value creation logic that the value network represents will be introduced in the value creation framework.

Culture

Culture is a broad notion in social science; even the culture within organizations is rather vague. In figure 5, drawn by Foss and Saebi (2015), it represents the core value creation logic of a firm. It conveys what a firm sells and how a firm does business. From the extant literatures, the definition for corporate culture is given as the pattern of shared values and beliefs that helps individuals understand organizational functioning and thus offers them norms for behaviour in the corporation (Deshpande and Frederick E. Webster, 1989). Corporate culture has also been studied for pursuing the corporate sustainability (Linnenluecke and Griffiths, 2010).

Product-based BM

The product-based BM focuses on selling as many products as possible and appealing market shares on the customer sectors they target (Foss and Saebi, 2015).

Service-centred BM

The service-centred BM focuses on supporting customer's value creation besides than selling products and services (Foss and Saebi, 2015) (Normann, 2001).

2.1.3 A cognitive perspective of BMI

There is, of course, a wide extant literature dealing with the corporate culture or inter-organizational cognition. Some research has also connect the corporate culture to the firm's management strategy (Hynes, 2009). Others research even points to the role of managerial cognition in particular to express that the cognition inertial will be the obstacle of BMI (Chesbrough, 2010). However, the corporate culture that effects or even drives the BMI has not received much attention so far. This is particularly true when it comes to inter-organizational cognitions, which is considered as the role of the corporation and its businesses that are shared by the corporation's managers and its stakeholders.

Though the research on the cognitive approach on corporate BMI is completely under-researched, the single case study on Nokia implemented by Aspara et al. (2013) gained awareness by discovering the connection between corporate business model transformation and the inter-organization cognition. The study also tried to find out how managers cognitive processes can influence corporate business model transformation decisions (Aspara et al., 2013). Until recently, a cognitive approach as created by Martins et al. (2015) for firms actively implement BMI in order to avoid the cognition inertial.

2.1.4 A dynamic context perspective of BMI

Currently, there are quite many literatures about a firm's BMI. It is a method a firm employs to adapt to technology or regulation change (Chesbrough, 2010, Teece, 2010), and also a procedure that a firm employs to adapt to new competitive scenery. It is normally triggered when the technology turns out to be out-of-date, customer requests change, and new value propositions emerge (Casadesus-Masanell and Ricart, 2010, Foss and Saebi, 2015).

Apparently, technology development as one element of dynamic context plays an important role in BMI. Teece (2010) proposes BMI together with technology innovation. He clarifies that the technological innovation often needs to be matched with BMI in order to capture value or create profit for innovator. He highlights the importance of BMI that BMI may not seem daring but without it there may be no reward for pioneering individuals, corporates and nations (Teece, 2010). Baden-Fuller and Haefliger (2013) believe that in order to appropriate features of a technology that create customer value, BMI may be needed to allow technological development. Moreover, firms can also view the business model as a source of innovation, not just as facilitating technological innovation and the management of technology (Zott et al., 2011, Mitchell and Coles, 2003).

The BMI is clearly presented as a theory founded together with business model theories. In addition to introducing the nine building blocks of a business model, Osterwalder and Pigneur (2010) recommends epicentres of BMI. They encourage practisers that these nine BM building blocks can be an excellent starting point for BMI. Likewise, innovating nine building blocks of business model is undoubtedly suggested as the approach of BMI in firms according to Osterwalder and Pigneur (2010). Moreover, the technological innovation is part of BMI based on the theory of (Zott et al., 2011, Mitchell and Coles, 2003, Teece, 2010). However, the BMI study is still in its early stage. Very few literatures have developed this part of theory, especially in the energy sector. After thorough literature search, a study on BMI in energy utilities in the German energy sector is reviewed as one of the more representative current literature.

2.1.5 BMI in the energy sector

With the perspective of electricity generator-energy utilities, Richter (2013) uses the business model concept to examine how German utilities place themselves while facing the challenges of the energy transition – the trend of promoting renewable energy utilities. Though it is the case study in the German energy sector, it is still practically and academically useful for the study in Norwegian energy sector due to a limitation on relevant research base.

According to the results, technology helps utilities creating new business model on renewable energy. The value proposition of this business model is mass generation of electricity, and the value creation logic of these renewable utility projects is similar to traditional centralized power plants (Richter, 2013). Though the research outcome has limited contribution on business model and value proposition of suppliers in the Norwegian energy sector, the clear introduction of the Europe energy utility and energy policy, and the methodology of comparing two sides of business model elements shed light on the BMI study in the Norwegian energy sector.

2.2 Value Creation Framework

The value creation and value capture is the keyword among all the business model definitions, and it is one of the main themes. In order to employ BM and BMI to capture value, the elements of business model are studied and generalized by scholars in former studies. Former reviews uncover a solid consensus that the business model revolves around customer-focused value creation (Chesbrough and Rosenbloom, 2002).

Stabell and Fjeldstad (1998) conduct a four-year study having supervised extensive utilization of the value chain model in more than 24 companies from a mixture of industries. In this study serious problems are pointed out when applying the value chain framework. They find that the primary activity typology of the value chain appears well fit to describing and understanding a traditional manufacturing company. Moreover, they suggest that the value chain cannot describe the entire value configuration; in fact it is just the basic one out of three generic value configurations.

2.2.1 Value chain and its elements

Peng (2009) defines value chain as "goods and services produced through a chain of vertical activities that add value." Originally from Porter (1985), the value chain is proposed as a firm's competitive advantage.

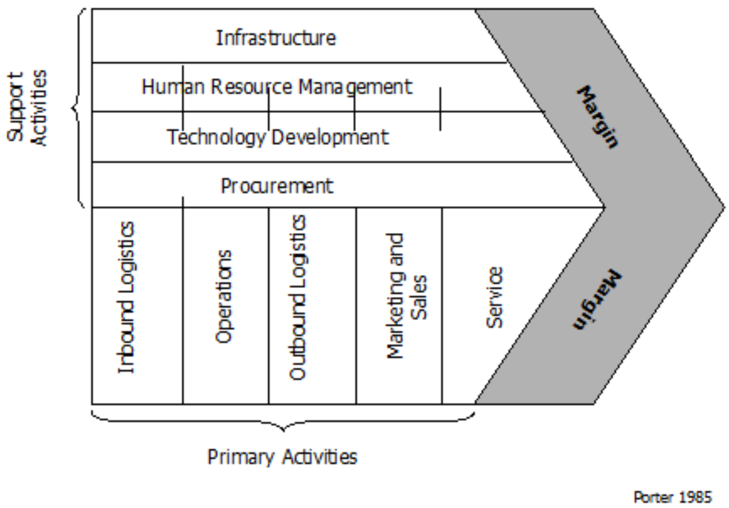

Figure 6 Value Chain (Porter 1985)

Primary activities

Stabell and Fjeldstad (1998) summarise the primary activities as:

- Inbound logistics: the activities linked with tracking and controlling the state of the goods. I.e. receiving, storing, distributing and so on.
- Operations: the activities associated with converting inputs into the ultimate product.

- Outbound logistics: the activities related with assembling, storing, and physically distributing the goods to consumers.
- Marketing and sales: the activities of developing all channels and implementing promotions in order to reach the customers and induce them to buy the goods.
- Service: the activities offering service to improve or add value to the product.

2.2.2 From value chain to value shop and value network

Based on Porter's value chain theory, Stabell and Fjeldstad (1998) extend the value configuration from value chain to value shop and value network.

As another type of value creation logic other than value chain, 'value shops' is created as a model firm that depends on an intensive technology (Thompson, 1967) to solve customer's problem (Stabell and Fjeldstad, 1998). Firms that can be sculpted as value shops are usually filled with specialists and experts, often professionals, covering the problem domain. The value creation logic of value shop is explained as problem solving, and changing an existing firm to a more desired state directed by intensive technology for the customer (Stabell and Fjeldstad, 1998).

And the 'value network', according to Stabell and Fjeldstad (1998), is a value creation logic that firm relies on via mediating technology (Thompson, 1967) to link customers who are (or need to be) interdependent. The mediating technology helps discussion among customers allocated in space and time; the firm itself is not the network but offers a networking service (Thompson, 1967, Stabell and Fjeldstad, 1998). In a word, the value network logic as one of the three value creation logics, is neither selling physical products as value chain, nor selling professional service or consultancy as value shop, but selling its linking service to all the customers who can benefit from this mediating organization or a club manager.

2.2.3 Firm's culture and cognition based on value creation logic

In the fast changing technology innovation world, correctly setting the enterprise boundaries is vital. It is the reflection of a firm's culture and cognition, and it can be seen as a factor to correctly apply the business model. The study of value configuration traces back to the firm's culture and cognition and more. (Teece, 2007)

- Cognition as value shop

In value shop, the business value system scope and the product scope are profoundly interconnected. The choice of business value system scope is based on market size and the rate of change in the technology. The bigger the market for a domain and the larger the rate of change in the technology means less vertically integration for a firm. Additionally, the firms that can be modelled as value shops have a high degree of absorption of the problem object within the field. Problem absorption can lessen uncertainty but also increase communication between experts and customers. Degree of problem absorption is related to the degree of business value system scope, since benefiting from strong problem absorption requires that the shop have access to a full range of related experts (Stabell and Fjeldstad, 1998).

- Cognition as value network

In terms of value system scope, the mediating industry needs to consider both vertical and horizontal integration. These possibilities reflect the layered and interrelated nature of the associated business value system. When the value chain commands a machine bureaucracy organization of primary activities, the value shop is arranged according to either the professional bureaucracy or the operational adhocracy; and the value network is often organized according to an administrative adhocracy, particularly when the technology of the infrastructure is complex and requires highly specialized development activities (Stabell and Fjeldstad, 1998).

Furthermore, there is one thing that needs to be highlighted: most firms are not limited in one value configuration; they may employ more than one technology and consequently have more than one configuration (Stabell and Fjeldstad, 1998).

2.3 Dynamic Business Model

With swelling market dynamics and fast technological developments, the ability to sense and adapt to threats, seize difference and value, and transforming technological capabilities in order to facilitate new and valuable user experiences will be a key contribution to a firm's sustainability. To be able to offer these experiences, a dynamic business model is needed, and a dynamic business model framework is generated in the study of Kijl et al. (2005).

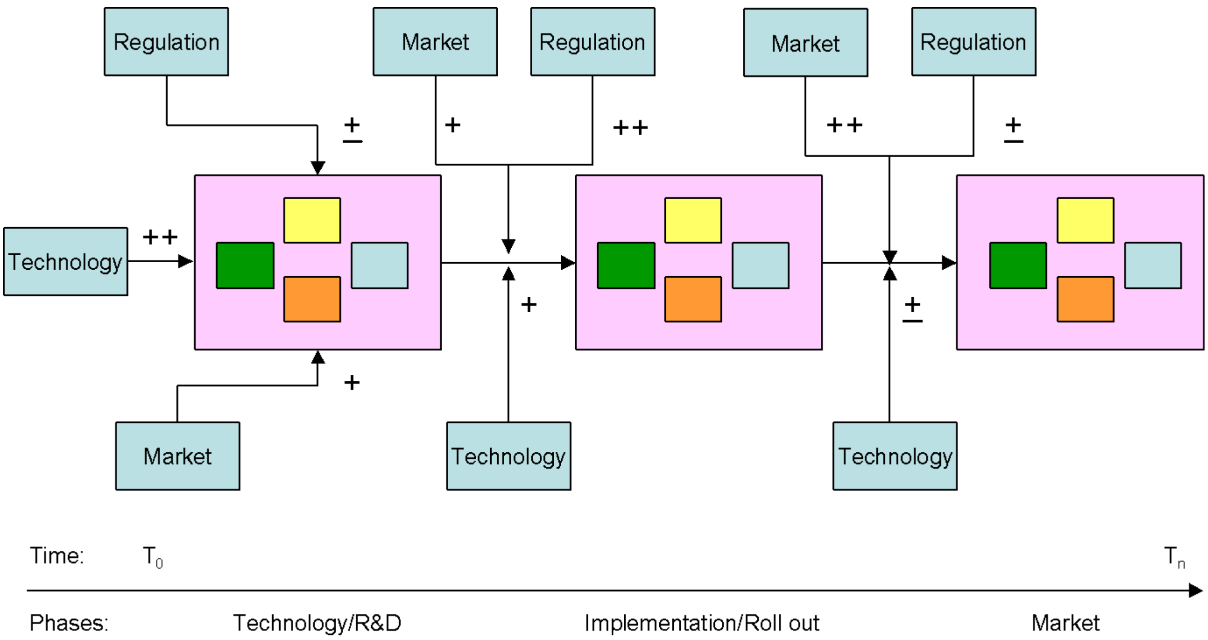

Figure 7 A dynamic business model framework (Kijl et al., 2005)

In this framework from Kijl et al. (2005), each big block with four small blocks inside represent the business model in the framework. The four small blocks represent the four pillars of a business model. The smaller blocks around the bigger blocks represent outer impacts that may influence BMI. Three types of outer impacts have been distinguished: (1) market opportunities or threats, (2) technological developments, and (3) regulation or policy. The time line in the model represents the business models evolving over time and the numerous phases can be seen as well. Three symbols ++, +, and ± are used in the framework in order to show the level of importance of each elements in each phases. The ++ stands for high expected importance, + for medium expected importance, and ± for low expected importance. Figure 7 shows that, in a technology driven industry, the technology is the most important environmental factor in the technology/R&D phase. In the implementation/roll-out phase one should overcome potential legal limitations, and get the most benefit from innovating business models according to the regulations. Then in the market phase, regulation still may have an impact but the market issue becomes the most important.

This dynamic business model from Kijl et al. (2005) includes market, technology and regulation as the elements of dynamic context, so it develops the BMI theory to a dynamic framework. As mentioned earlier, in order to adapt to new competitive scenery triggered by new technology, customer requests, and new value propositions, a firm applies BMI (Casadesus-Masanell and Ricart, 2010, Foss and Saebi, 2015). As such, the BMI study needs to combine the business model elements and the dynamic business model elements. Thus, an in-depth BMI study needs to include offering, infrastructure management, customer interface, financial aspects, and dynamic context that includes market, technology and regulation.

3 Research Methodology

The research question that, together with the conceptual framework, guides this study's design and data collection methods is:

How do suppliers in the Norwegian energy sector employ BMI to adapt to the energy change?

3.1 Research design

Based on prior studies and motivation, the research question was selected, and the research perspective on BMI in specific Norwegian energy sector was targeted. Furthermore, two suppliers in the energy industry were specially chosen.

Yin (2009) states that a case is a realistic investigation that explores a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly manifested.

Therefore, a case study design is chosen according to Yin (2009) because (a) the research question is a 'how' question, related with finding out the actions that a company takes to adapt to the context change; (b) the investigator cannot direct or influence the performance of the events; (c) the context is relevant to the phenomenon under the study, and (d) the question may require an in-depth analysis of a specific problem.

Also, it is advised by Yin (2009) that if you have a choice of resources, multiple-case designs could be preferred over single-case designs, since the analytic conclusions individually ascending from two cases will be more compelling and robust than those coming from a single case alone.

Thus the research design chose a two-case comparative case study. The units of analysis are:

1. Product-based supplier, market leader in energy-related products; (ABB Norway)
2. Service-centred supplier, market leader in energy-related service. (DNVGL Norway)

Moreover, it is most likely an exploratory case study because the aim of this research is to develop a better insight into a particular topic. In the timespan of writing this study, the earlier work / previous studies that can be referred to seems very little. The main focus of this study is the scenario of suppliers in the Norwegian energy sector in the energy context change. It is entirely an in-depth analysis of a distinct problem within real-life context, and it employs focus groups, in-depth interviews, historical analysis and observation (Wilson, 2010).

3.2 Conceptual framework

This research followed the conceptual framework and the process of inductive case study approach as set by Eisenhardt (1989). The conceptual framework method is especially appropriate in new topic areas, and for inductive explorative case study.

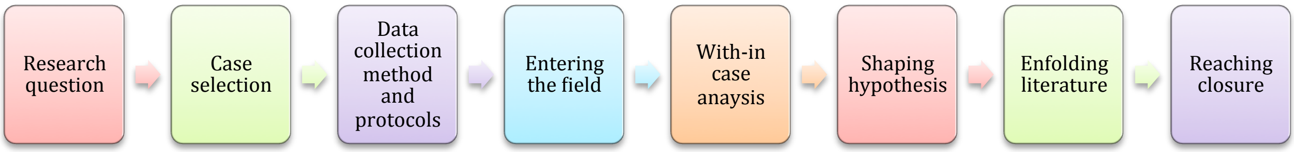

Figure 8 Conceptual framework for inductive case study by Eisenhardt (1989)

3.3 Introduction of analysis units

For better comparison, a simple form is drawn to briefly introduce these two analysis units.

Table 3 Introduction of analysis units

Elements	Company A - ABB	Company B - DNVGL
Year founded	1883	1864
Number of employees worldwide	140000	16000
Number of employees in Norway	2500	1900
Headquarter	Zurich, Switzerland	Oslo, Norway
Operate in countries	120 countries	100+ countries
Business Units (BU) in Norway	5 BUs: Power Products, Power Systems, Process automation, Low voltage products, Discrete Automation and Motion	5 BUs: Maritime, Oil & Gas, Energy, Business Assurance, Software
Mission	Power and productivity for a better world	To safeguard life, property and the environment

Company A—ABB is a global leader in power and automation technologies. It is the largest supplier in the world regarding energy products that include power generating, transforming as well as transferring. ABB's main competence and business model are focused on how to use the energy efficiently and stand for the top level of technical innovations among competitors in the market. In Norway, ABB's products cover all energy sectors such as oil and gas industry, hydropower, wind power, electronic auto, solar industry etc. In conclusion, ABB is a product-based supplier that offers a broad product portfolio in the energy sector.

Company B—DNVGL as the world's largest classification society owns the main expertise in technical assurance, research, certification, and risk management. DNVGL is also a reference in both renewable and conventional energies. It is the world's largest technical consultancy to onshore and offshore wind, wave, tidal, and solar industries, as well as to the global oil and gas industries. After acquiring KEMA at the year 2011, and merging with GL at the year 2013, DNVGL is the biggest energy certification and consulting company worldwide.
According to the range of the energy sector where ABB and DNVGL either supply products or services, it is apparent that both of them face the same ambient context across the total energy sector even though they have different value creation logic.

3.4 Data Collection

As explained in Yin (2009), the research method is using different techniques for collecting data. Yin (2009) suggests that there are broadly six main sources of data collection, each of which has its particular strengths and weaknesses. For these two specific cases in the study, two main sources are relied on due to the realistic issues and the nature of the research: documentation and interviews.

3.4.1 Primary Data

The methods of collecting primary data are based on several kinds of interviews: face-to-face interviews, interviews by phone, and sending questionnaires by email. I sent out three emails with questionnaires to the potential interviewees who could not make it to the face-to-face interview. One relevant answer was received. Therefore, the interviews of this research include three face-to-face interviews; one done by email and by phone for additional confirmation. A direct observation is not applicable based on the research question, since this high-level business strategy can hardly be observed by a short visit at the firm. In total, the interviews were performed with four participants that consisted of a senior vice president, a strategy department head, a senior manager and an analyst mainly from the renewable energies department. The detail regarding the interviews, such as the length of the conversation, is shown in the Table 4 (In the analysis part, A1 represents the interviewee number 1 with company A, the same applies for A2, B1 and B2).

Table 4 Primary data collection

Analysis Unit	Interviewee 1 Position/ Time		Interviewee 2 Position/ Time	
A	Senior Vice President	1.5 hour	Analyst	1 hour
B	Head of the Strategic foresight department	1 hour	Principle Researcher (Senior manager)	1 hour

3.4.2 Secondary Data

Multiple recourses of secondary data were collected for the in-depth study on the two cases. The secondary data was mainly gathered from company website. Since both companies are the leader in their respective market, all the information they are required by law to publish to the public and their stakeholders is available of their website. The documentation includes a large number of reports from the company website and industrial websites, news from the company's internal media and industrial media, annual reports, meeting notes, internal journals, articles and industrial forums etc.

3.4.3 Data Reliability

Reliability concerns the extent to which a measurement of a phenomenon provides stable and consistent results; reliability also concerns repeatability (Wilson, 2010). Data reliability ensures the consistency of a measured result. To improve the data reliability of case study research, Yin (2009) suggests the following three principles that these were obeyed in this research:

Use multiple sources of evidence

A major strength of case study is that it gives multiple choices of sources. Due to the time limit, two sources are used in this study: documentation and interviews. This is due to the fact that a few hours visiting the company for conducting interview cannot count as direct observation, especially regarding the BMI topic that is a lengthy process.

Create a Case Study database

The interview was designed and guided following the elements of BMI and dynamic context. After the interviews, a formal, presentable database was developed. Some easy-to-catch forms were created conveying the brief background information of the interviewees and analysis units, the data type and resources. The main purpose of making this database was to make it easy for other investigators to review the data directly and not be limited to the written reports.

Maintain a chain of evidence

With the permission of interviewees, the interviews were well recorded by the app voice memos that were installed on the used equipment—an iPhone and an iPad. This record was subsequently carefully transferred in to written transcript by listening to the record slowly and word by word. The major interview questions and guides are attached in Appendix 1. Due to privacy concerns, the interview transcripts and interviewees' names are not published here.

3.4.4 Data Validity

Validity is related to the topics what researchers are measuring or intend to measure, and it refers to the relationship between a construct and its indicators (Wilson, 2010). Except for the reliability, the quality of a study can be tested by internal and external validity as well as construct validity.

According to Wilson (2010), the external validity means the extent to which the findings from study can be generalized to other cases or settings. A positivist researcher will often strive to claim generalizability of their results.

The author suggests that as an explorative case study, the general findings from this study may support other similar cases or settings, but due to the limited number of cases studied, as well as the time limitation for the whole study, the replication of logic cannot yet be achieved.

It is described by Yin (2009) that the internal validity is for explanatory or causal studies only and not for descriptive or exploratory studies. However the construct validity, part of internal validity is valid to the extent that it measures what it is supposed to measure. In this case

study, the primary indicators were the questions during the semi-structured interviews in accordance with research question followed by literature study.
Yin (2009) suggests the technique for improving validity in qualitative research by applying data triangulation—finding multiple sources, which supports a given finding—and that is accepted within this study.

In addition to data triangulation, Mays and Pope (2000) endorses some additional measures to improve data validity for qualitative research, all the suggestions below were used within this study.

- **Clear exposition of data collection and analysis:** The following section will follow this in result and data analysis.
- **Reflexivity:** It is defined as sensitivity to the ways in which the researcher and the research process have shaped the collected data (Wilson, 2010). The application for this suggestion is mentioned in the question design in the next section.
- **Attention to negative cases:** The contradict element in the data were also considered and analysed in care to ensure the validity of the findings.
- **Fair dealing.** To maintain the quality of research, the interviews were well planned, prepared, and performed. The depth and diversity of the conversation in the one to one and half hour timeslot can cover all the sectors, which are targeted by this research. Having two analysis units and with each of the unit working with two interviewees can very much minimize the dominant viewpoint.

3.5 Question design and interviewee selection

The interviewees selection was based on the function of the interviewee who directly works with BMI or implementing BMI. All the interviewees are experienced, high level, long time working at the firm and key persons in the organization who understand the research topic and associated field very well. Therefore the interviewees could guarantee the reliability of the data. Because of the interviewees' roles in the company are either the top leader in the firm who governs the strategy; or the energy change project leader, who performs the strategy, they are professionals who not only understand the study topic, but practically apply it in their daily work. This can highly prohibit personal and intellectual biases that may influence the data collection.

All the interview participants were provided with a semi-structured questionnaire guided by conversation. The questions were designed based on the overall research question and the objectives of the study: To seek the main approaches employed in the BMI conducted by the analysis units in this case study. Thus, the questionnaire was created following the categories that consist of dynamic context and business model pillars that were mentioned as the theory framework (Appendix 1).

The study is more of a flexible nature than a closed study. The author asked neutral and open-ended interview questions that would allow the interviewees to explicate freely upon the given subject. If needed, follow-on questions were used for clarification of topics already volunteered by the interviewee. Adjustment was on going when the new data was added.

3.6 Data Coding and Analysing

Coding is a method that serves as a way to label, compile and organize the data, as the basis for developing the analysis. A code can be a key word, theme or category within the interview transcript or notes (Wilson, 2010). With the consideration of data validity and data reliability, this case study strictly followed the methodology of acquiring data, coding, and analysing data.

The interview transcripts were carefully evaluated whilst creating notes in a systematic way. The data analysis will include both primary data and secondary data. Since the interview questions are designed to match to the data protocol, it is easier for data interpretation and information category. And the data from the protocols was conducted in a three-step process: First, referring the coding frame comprises five categories below (Figure 9), each category was interpreted into sub-categories comprising nine business model elements and three dynamic context elements; Second, the coded results were clustered into five main categories including dynamic context as well as four business model components: offering, customer interface, infrastructure management, and financial aspects; Third and finally, the results were grouped to recognise the relevant issues and enable a thorough and comparative analysis of the interview results.

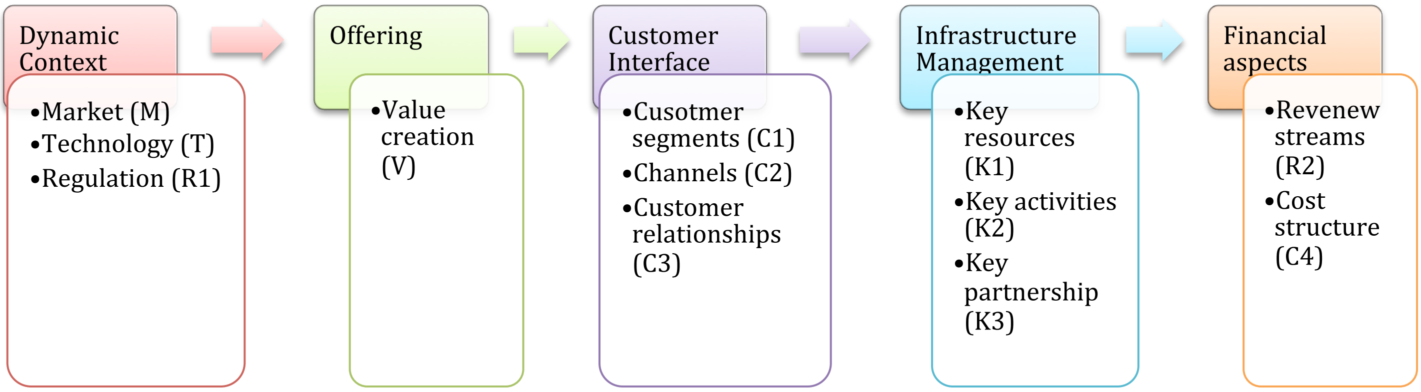

Figure 9 Methodology of data coding and data analysis (Osterwalder et al., 2005, Kijl et al., 2005)

Since it is a comparative case study, the BMI applied by ABB and DNVGL will be analysed following these five categories, and the more detail sub-categories will be studied and compared in each form. The results will be concluded in each sector, and will be highlighted in the discussion and conclusion.

Yin (2009) introduces four typical approaches for analyzing case studies, e.g. on basis of the theoretical propositions, developing a case description, using qualitative and quantitative data and examining rival explanations. The first approach is not proper because there are no theoretical propositions in this exploratory case study, and the third approach is not used because this case study research does not deal with any quantitative data. Examining rival explanations is not proper for this exploratory case study either. Hence, the most applicable approach to this exploratory study is a case description analysis.

4 Results Analysis

In this chapter the results from the interviews and the secondary data will be discussed in light of the previously presented literature. The analysis category and process are introduced with Figure 9 in the sector 3.6.

4.1 Analysis units in the dynamic context

This study follows the electricity production value chain and divides the energy sector into three main segments: energy generation, distribution and consumption. As commanding suppliers, ABB and DNVGL are active in all three segments depicted in figure 10 below. ABB is a product-based supplier, and DNVGL is a service-centred supplier in the energy market. Regulation and technology are two core dynamics in the external macro dynamic context that influence the energy market as well as the firm's business model.

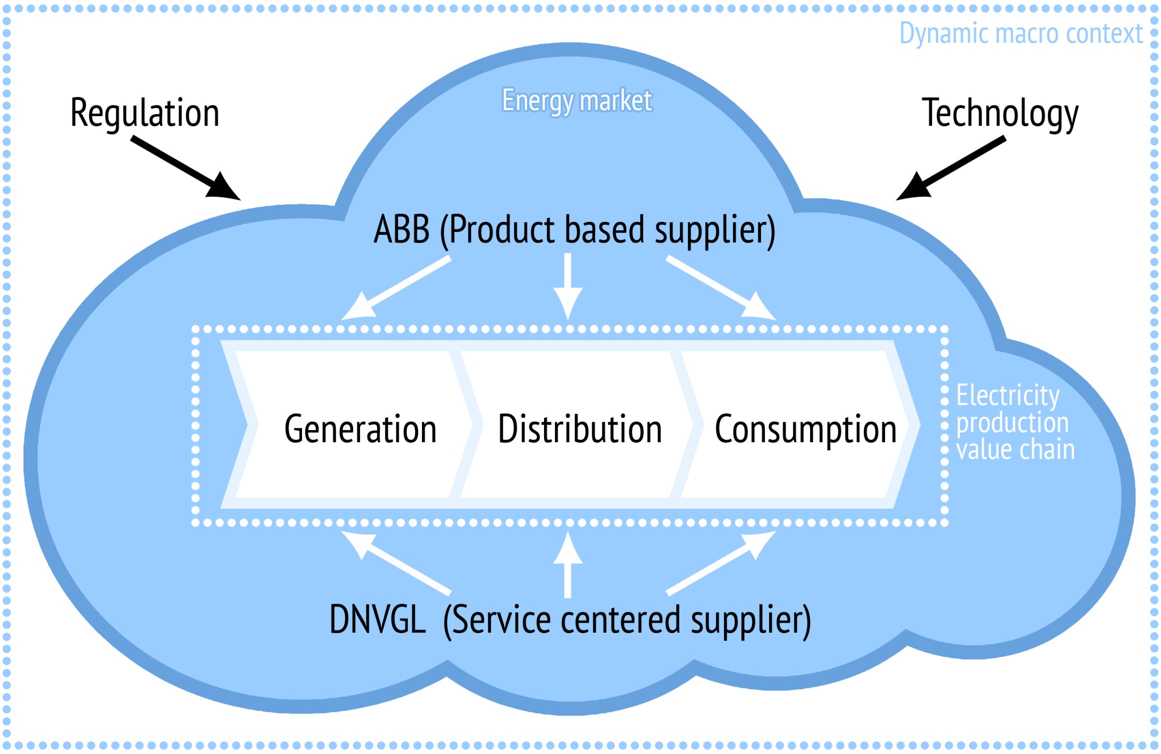

Figure 10 The role of ABB and DNVGL in the dynamic Norwegian energy sector

4.1.1 The government energy target and action on generation, distribution and consumption

Norway is a unique country with regards to energy resources, because almost all the electricity generated in Norway comes from hydropower. However, according to the

Enova[4]'s contractual goals, the contribution of renewables and energy savings still need to be improved by 30 TWh by 2016 and by 40 TWh by 2020 (compared with 2001) due to increased demand of energy. The established targets in the agreement by the Renewables Directive also show the high Norwegian ambitions in the renewable energy area. As is mentioned in chapter 1, the Norwegian renewable energy target is a percentage of 67.5 in 2020. In 2010, the percentage was about 61 (European Environment Agency, 2013a).
In addition to the demands in renewable energy, diversification in the energy generation is required and encouraged by the government through Enova and the energy fund. According to the action plan of Norwegian government, the licensed market welcomes three types of renewable energy: wind power, hydropower, and bio energy. Three core issues are important in the pursue of the climate friendly energy targets: nature diversity, local communities and other public interests (Ministry of Petroleum and Energy, 2013).
In order to realise this plan, the government has initiated many activities accordingly and has placed great emphasis on encouraging the supply of renewable energy. For example, the government increased the licenses issued in order to increase the energy production. From 2012-2020, the production capacity that will result in a total of 26.4 TWh renewable electricity production in Norway and Sweden in 2020 will be developed. This equals 20 per cent of the current Norwegian power production, and Norway is committed to finance 50 per cent of the certificates, regardless of the location of production in two countries. Moreover, the attention to the use of district heating has increased considerably. The government improved the scope of measures and instruments regarding renewable energy development and energy efficiency, an effort that will be continued (Ministry of Petroleum and Energy, 2013).

With the increasing production of renewable energy, the electricity system demands a well-functioning grid. Substantial emphasis has been placed on the investment on grid developments and the grid transmission capability and efficiency improvement. For example, Statnett has increasingly invested in grid construction and improvement, and the investment

[4] Enova is a Norwegian state owned enterprise founded at the year 2001, with the mission of energy efficiency improvement and renewable Norway as well as technology development in the energy sector. It manages the fund for the promotion of energy efficiency measures and the use of renewable energy (along with a broader Energy Fund financed through an electricity tax).

will remain high in the future. In the year 2010, the investment was nearly NOK 1.9 billion (Ministry of Petroleum and Energy, 2013).

With regard to the energy sector's innovation towards more renewable energy and energy efficiency, the efforts are also placed through extending investment in research and technology development. Through the Norwegian Research Council, programmes for developing technology and knowledge on renewable energy, energy efficiency and environmentally friendly transport have been reinforced and recorded in White Paper No. 21 (2011-2012). Also, the parliament asked the government to establish a new fund for climate, renewable energy and energy diversification. The capital fund will increase by NOK 5 billion in 2015 and NOK 5 billion in 2016. Another statement mentioned in the White Paper No. 21 (2011-2012) is that the government will increase the mandatory sale of biofuel to 10 per cent if the experience is good with regard to the sustainability criteria. Moreover, the government will support the development of the value chain for second-generation biofuel and contribute to biogas development in Norway (Ministry of Petroleum and Energy, 2013).

The energy consumption includes three main parts: industry, residential and transportation. In White Paper No. 21 (2011-2012) Norwegian Climate Policy to parliament, the government has proposed a new climate and technology initiative, which is funded through the yields from the national capital increases. The White Paper also presents a labelled action plan with the goal of reducing overall energy consumption significantly by 2020 in the construction and transportation sectors. The target is to increase the use of energy carriers for heating from renewable electricity, and the energy efficiency measures in the industry segment and buildings with new energy technologies. Among other things, Enova is to accelerate renovation to environment-friendly energy consumption in households, and to a more energy-diversified and security-improved energy supply in the consumption segment.

Renewable energy in transportation is encouraged in Norway. It has been calculated at 4860 ktoe (thousand tonnes oil equivalents) in the Norwegian transport sector in 2020, and the Renewables Directive requires Norway to achieve 10 per cent renewable energy in the transport sector by 2020. The share of renewables in transport has increased from 1.3 per cent in 2005 to 4.0 per cent in 2010. In particular, more efficient passenger cars contribute to the estimated total in the energy efficiency improvement plan. The government set the goal for the average emissions from new passenger cars in 2020 to not exceed 85 g CO2/km2, thus continued efficiency improvement and introduction of more energy-efficient vehicles are expected. Some additional acts to decrease energy consumption may include a further transition in cargo transport to sea and rail, as well as a transition from road to public transportation, bicycles and walking.

Through recommendation to the parliament No. 390 S, the efforts have been strengthened further. The most obvious effort in this segment will be the current tax benefit. It will be continued through to the next parliamentary term (2017), as long as the number does not exceed 50,000. Appendix 3 contains a summary of the regulation support schemes for tax benefit in the Norwegian energy sector.

4.1.2 How do leading suppliers adjust to the changing environment?

As the leading suppliers in the energy sector, ABB and DNVGL both sensed the change and took actions to adjust to the new regulations by developing new technology and promoting new markets. In view of the primary data, all interviewees declared that energy change is driving both companies' business units towards renewable energy and an energy efficiency oriented setting. This is the main reason to use BMI as framework for this research. ABB and DNVGL both agree that the regulation is a particularly dominant factor in the energy sector, and that it directly effects the technological development and the energy market. As mentioned in the introduction, the smart grid technology has been developed in recent years, and it is already contributing to energy efficiency and energy diversity. ABB is the top innovator in the smart grid technology, and targets to build a futuristic smart city based on their more than 1085 patents.

The dynamic context has affected both ABB and DNVGL in their technology innovation and new business model generation. As a pioneer in the electricity transmission, ABB is leading the smart grid technology in order to adapt to the new pattern of generation. One example of an early smart grid project that ABB is involved in is the Sweden Gotland smart grid project. It is an example of how to adapt an existing electricity network to modern conditions. It is covering various requirements and examining all aspects of smart grids, like many other project that ABB leads, comprising e-mobility and energy storage to network management, metering and communication, distribution automation as well as home automation systems (ABB, 2012). Instead of offering smart grid hardware and software equipment, DNVGL supplies all kinds of services related to cutting edge smart grid training and consulting services, engineering design and testing services, as well as other license services.

According to the regulation effect, A1 explains the government encouragement on energy production and associates it with the recent electricity price decrease in Norway and the Nordic countries. He believes that increase of the electricity production may result in a price drop, but it also gives new possibilities to the Norwegian energy production industry as the main electricity supplier in Europe. Since a lower electricity price will create a demand for it, and in the end stimulate the industries in Norway.

DNVGL's strategy and business model is dominated by the climate change and low carbon ambition. According to the report from Jones (2015), the electricity systems around the world are changing, and one of the most overwhelming changes to the power system is the expanding share of solar and wind energy. The target of fighting with climate change, providing secure energy supplies and protecting electricity consumers is challenging. The regulations are struggling to keep up with technology, and the business models are being created and destroyed.

Interviewee B2 who has a PHD in the energy field is a professional in energy change research. As a principal researcher in DNVGL's low carbon team, she emphasizes that the energy sector is very much depending on government regulation. Therefore the company fluctuates with the changes in this political playing ground. However B2 thinks it does not exactly pressure their business model and their value proposition as a service company. However it does affect the demand of the service. If there is a slowdown in investments in a specific type of energy, then it slows down the demand of services that DNVGL supplies to the value network.

As leaders in their respective field, ABB and DNVGL both consider technology as its strong competence in the dynamic energy change context; and they both show the needs to focus more on technology innovation regarding energy and climate change, strengthening customer relationships, creating new services and products and innovating their business model. In conclusion, the table below sketches these two companies' innovations in the dynamic context.

Table 5 Dynamic context change and the general innovation applied by ABB & DNVGL reacting to the change

Category 1	Sub-category	Three main segments in the energy sector		
		Generation	Distribution	Consumption
Dynamic context	Market	Demand: more generation; more diversified renewable energy	Demand: higher capability and efficiency; more power lines and power stations	Demand: renewable transportation; renewable electricity and higher energy efficiency building
	Technology	Fund by government to develop more renewable and more efficient energy; wind power utilities, solar PV technology	Smart grid, higher efficiency and capacity; higher energy security	Improving energy security and energy efficiency; smart building technology such as meters etc.
	Regulation	Create new regulation to stimulate diversified renewable energy and build organization managing fund to develop associate technology	Create higher standard on energy system and invest more on grid development and construction	Generate new regulation target a more environment-friendly, energy-diversified and security-improved energy consumption on building and transportation
Innovation reacting to the dynamic context	ABB	Develop and attract more electricity production firm diversified from energy recourse	Lead smart grid technology as well as HVDC technology	Smart Meter and energy management system to residential and industry
	DNVGL	Start all kinds of project team targeting different renewable production business	Develop all kinds of services including training, consulting, testing and license service etc.	Smart meter and energy management, policy consultancy and license service

4.2 Offering

A firm's offering is its value proposition to the customers either through products or services. As a leader in power technologies that enable customers in the energy, industry, transport and infrastructure to improve performance whilst lessening environmental impact, ABB's offering mainly comprises products and engineering services covering all of the electrification value chain: energy generation, transmission and consumption. Its product portfolio covers all the products in the electrification system, for example: generators, switchgears, and transformers, SCADA, motors, and electrical charging solutions etc. It was vividly explained by A1 during interview as he links ABB's business to a simple plug. He presented that ABB supplies all the equipment and service that is needed to bring the electricity to wherever you want.

ABB has just finished their strategy and new business model for the 2015–2020 period. The new strategy lays the foundation for its implementation and hence for enhanced sustainable value creation (ABB, 2014). Innovations in ABB´s business model are clearly seen in all electrification segments (Figure 11).

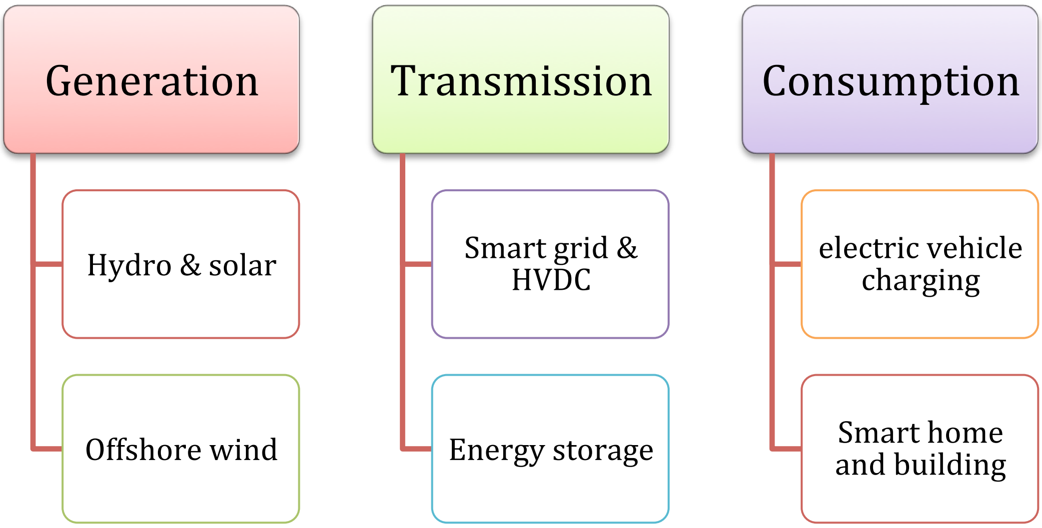

Figure 11 ABB's innovative offering for improving renewable energy and energy efficiency

In the power generation segment, the types of renewable electricity production that ABB is involved in are hydro, solar, and offshore wind. Smart grid technology enables ABB to connect all three segments through advanced technologies. When properly implemented, these technologies will increase efficiency and reliability of the system. For example, the capacity of existing power lines can be tremendously increased by using flexible alternating

current transmission systems (FACTS). The smart grid and energy storage technology led by ABB provide the firm with great market potential in Norway during the energy change.
On the consumer side, ABB places attention on two fields: electrical vehicle charging and smart home. The tax support schemes (Appendix 3) provide very good benefits for owning electric vehicles and are among the best in the world. This also benefits suppliers like ABB Norway. ABB offers charging solutions that include engineering services; this includes all types of chargers and software services. According to the recent new regulation on renewable energy building, ABB can improve the energy savings between 30 and 60 per cent of the total consumption of buildings with their energy efficient technologies. These include intelligent controls that adjust the temperature, lighting, and energy consumption of electric applications regarding actual requirements. With the innovation technology, such intelligent building systems can operate independently of the power grid. The building can interact with the grid to give consumers better control over the amount of electricity they use as well as when they want to use it. This smarter network will help customers lower their electricity bills as well as enhancing the overall efficiency of the system.

Unlike ABB, DNVGL is a typical service company. Instead of supplying products, it offers services to the customer. Helping customers find new solutions, innovations, and technology qualifications is DNVGL's core service. Their target is to shorten the time it takes to bring technology into the market. B2 mentioned that their service also includes being an independent pair of eyes to keep focus on risks and challenge management. DNVGL is perceptive of government attention and regulation; additionally it creates energy standards and regulations and pushes all levels of government to accept it. When the energy change starts, it is already prepared to work together with climate change science and use this knowledge in their organization together with other stakeholders. The same reaction happens to the trend of renewable energy and the electricity efficiency business. It tries to follow the trends in both technology and investment development. DNVGL expands its service in the energy sector by involving almost all the cutting-edge renewable energy types, and makes money by selling its knowhow and authority services, such as policy consultancy, engineering (design, testing, assessment), assurance, licenses, certifications and trainings etc. As been told by interviewees as well as learning from the secondary research, DNVGL's main service offering comprises three modes: consultancy, certification and assurance (Figure 12).

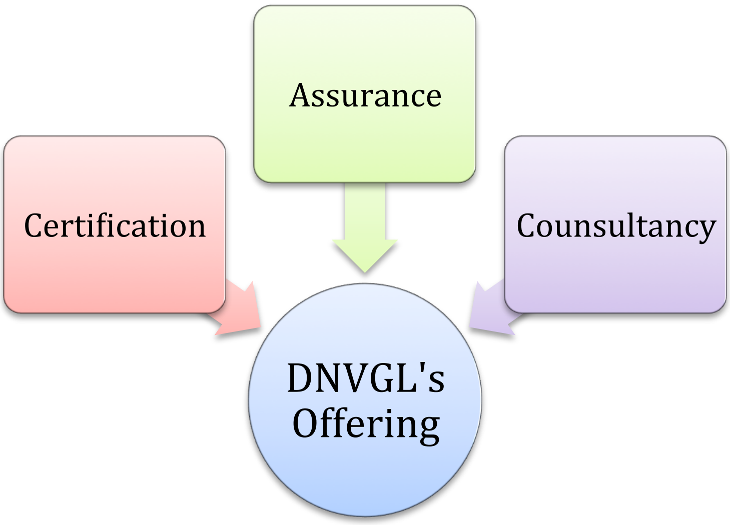

Figure 12 DNVGL's three main value proposition

A more detailed overview on the offerings of DNVGL adapted to the energy change is presented in Figure 12. In the energy generation and transmission segment, DNVGL's service includes all renewable energies and the smart grid that can integrate diverse energy types and deliver it with high efficiency. In the consumption segment, DNVGL focuses on policy consultancy to the firms that operate in the energy network such as construction companies. In conclusion, the services that DNVGL offers to the entire electrification value train include technology development, engineering, policy consultancy, licensing, assurance, and training etc.

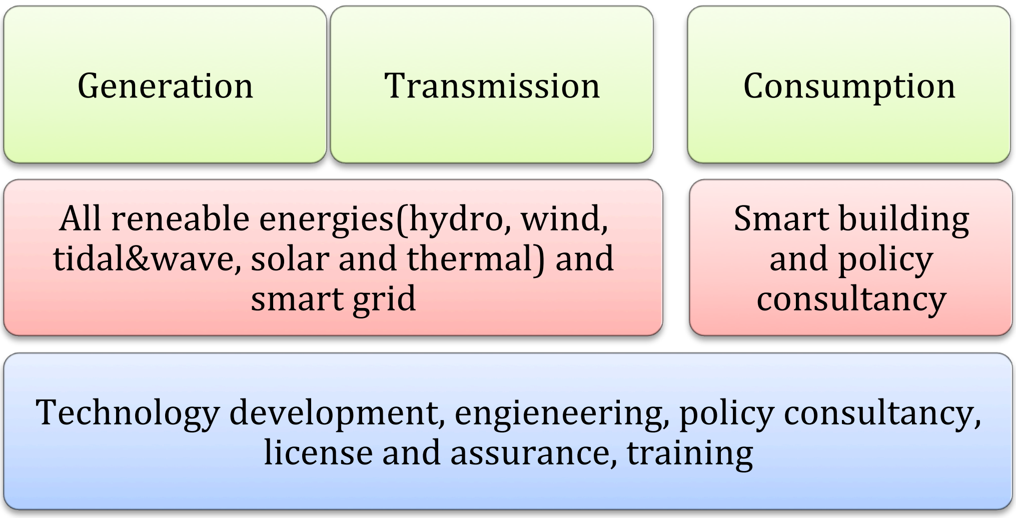

Figure 13 DNVGL's innovating offering for improving renewable energy and energy efficiency

B1 believes that the need of BMI is derived from the preceptors when there is some disruption in the market, because the firm and manager need to think about how to sell the service and what service the firm can sell for a healthy future.

DNVGL is on demand of more new models for business and for regulating the power sector, and it also applies BMI as a measure tool, to think systematically about new business areas and different markets. On the basis of the power transmission technology and the whole power system, DNVGL is planning to move to a system with a very high proportion of renewables that demands more than simply ‘integrating’ the new generation with the existing infrastructure and processes (Jones, 2015). The following new BMI framework within the energy sector is introduced by DNVGL. It suggests that companies like DNVGL or ABB, which operates across energy sectors, may benefit by expanding into an Internet energy business by forming up new partnerships (Jones, 2015).

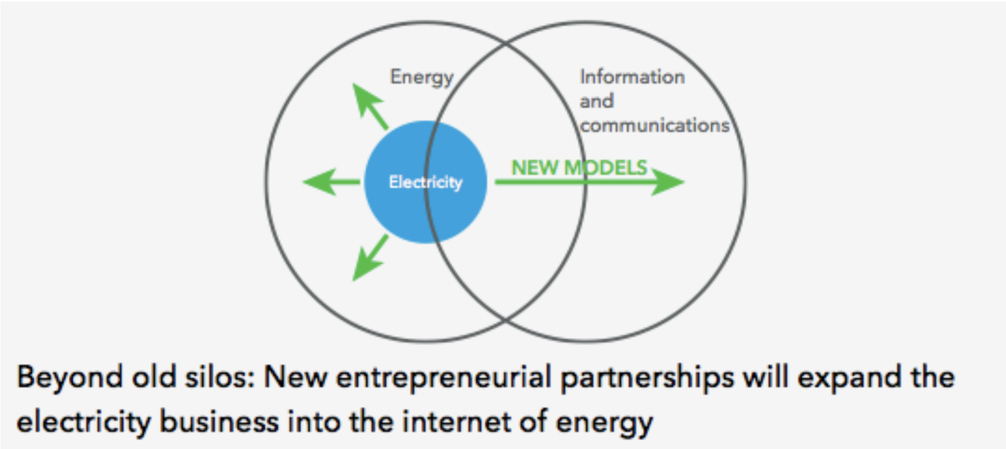

Figure 14 Beyond old silos: Subsector arbitrage (Jones, 2015)

The table 7 below is presented in order to summarize and compare two firms’ offering:

Table 6 Offering analysis

Pillar 1	BM Blocks	ABB	DNVGL
Offering	Value Propositions	**Products + new technology** • Generation Hydro, solar, wind • Transmission Smart grid, HVDC, energy storage • Consumption Electrical vehicle charging, smart home and building	**Service (assurance + licence + consultancy)+ new technology** • Generation Solar, thermal, wind, tidal and wave • Transmission Smart grid, energy storage • Consumption Policy advisory and research Smart home and building

As the leader of the low carbon project team in DNVGL, B2 believes changing or innovating the business model is a huge thing because it needs to change the mind-set of their customers and stakeholders. Though the new value proposition is not easy to settle, the existing value proposition could be innovated from different angles as another solution of BMI. In addition, both B1 and B2 think the purpose of any value proposition change is to establish the company value as 'safe environment'.

A business model is the carrier of the value creation logic, thus a new offering needs a new business model. A single firm may employ more than one technology and hence have more than one value configuration (Stabell and Fjeldstad, 1998). Firms are normally not limited to a single distinct value configuration. In chapter 2, three types of value creation logic are introduced: value chain, value shop and value network. The logic of the value chain (Figure 6) is explained as being based on variants of cost leadership, and the flow logic of the primary activities limited in buyer-purchasing criteria. On the contrary, the firms that are based on value network models create value by facilitating a network relationship between their customers using a mediating technology. Furthermore, the firms that are based on value shop models create value by mobilizing resources and activities to resolve a particular problem the customer has (Stabell and Fjeldstad, 1998).

In light of the value creation theory framework, of a product-based firm, the value creation logic of ABB includes both value chain and value shop. To service centred firm DNVGL, as explained clearly from the interviews and internal media, its value creation logic includes both value shop and value network. Due to the difference in value creation logic, the difference between ABB and DNVGL in applying BMI is clearly seen by comparison of Figure 11 and Figure 13. ABB's offering did not expand on all renewable utilities comparing with DNVGL. All the activities that ABB took to innovate the business model are mainly technological developments on improving its capabilities. It is seen from Figure 11 that the three segments represent the business that ABB has been involved in for decades. The innovation by technological development enables the smart grid and facilitates the renewable power plants for energy efficiency improvement and new renewable energy generation adaption, as well as new business model adaption. Hence DNVGL is more flexible in innovating its business model. The traditional business DNVGL has been running for centuries is the assurance and certification service. After a few merging and acquisition in recent years with KEMA and GL, DNVGL became the world biggest industrial service and assurance, certification supplier. Thus as a pure industrial service company, DNVGL keeps an extremely high sensitiveness on the regulation and all the possibilities in the renewable energy sector. The entire innovated offering generated recently as shown in figure 13 has a high-level of diversification of services that are offered across energy sectors. A shift from value shop to value network in DNVGL was confirmed by interviewees and it is also seen from the activities on service-oriented BMI. Yet, the common part between ABB and DNVGL on offering is that the technology development and commercialization lead the entire new business model to respond to the dynamic context based on the demand of renewable energy and energy efficiency.

4.3 Customer interface

The customer interface explains the interaction between a company and its customers. Customer interface includes customer segment, channel and customer relationship.

Since ABB is the main equipment supplier in the energy sector, the power production companies (utilities) and the electricity network companies are the main customers from the generation and transmission segments. From the latest statistic report by Statistic Norway, the electricity produced from hydropower accounts for around 95% of the total electricity production in Norway, the rest is contributed by thermal and wind power. Thus, Statkraft as the biggest state owned energy-generating company is the main customer in the energy generation segment of ABB Norway, as explained by A1. Interestingly, A1 further introduced the Norwegian energy policy and society to explain ABB’s market context in the energy sector. The principle is that all the energy that is produced in Norway belongs to the country, the community and the people. Private companies can operate the utility, but the country owns it by leasing the operation rights to them and taking a share of the profit.

Statkraft is the main national power generation firm in Norway. It owns 273 hydro power plants, 25 district heating plants, and 3 wind power plants (Statkraft, 2015). During the interview, A1 confirmed the importance of the business with Statkraft, he mentioned that even though the profit from the framework agreement signed between ABB and Statkraft is very low, it can help them securely achieve the annual sales target.

An even more important customer to ABB is Statnett, the state-owned power transmission and operation company. According to the recent news, Statnett just awarded ABB a 240 million Kroner contract of nine transformers related to the Western Corridor power upgrade, which is currently being implemented to increase capacity in the main grid. The transformers will help to increase the transmission capacity in the main grid, which means it will improve the power supply reliability and support more renewable energy transmission in accordance with the regulation and target for 2020 (ABB, 2015b).

Except the projects run in Norway, Statnett has some very big projects collaborating with other countries. ABB Norway won the two largest contracts from Statnett this year as equipment supplier. One is a $450 million order for Norway-UK HVDC interconnection with the target of increasing power supply security for both countries and supporting the integration of more renewable hydro and wind electric power into the networks. Another order awarded to ABB by Statnett at March 2015 is worth $900 million, ABB will contribute to on-shore HVDC converter stations and facilitate the first ever interconnection between the Norwegian and German power grids.

In the electricity consumption segment, there are two types of customers for ABB: the customers that are companies such as electric vehicle charging stations and construction companies; and public consumers who buy the smart house solution. At the 19th of May 2015, ABB has installed and commissioned its 100th fast charger for electric vehicles, at Eikelandsosen near Bergen in Norway. The owner of charging stations is Fusa Kraftlag SA and the operator is Grønn Kontakt[5] (i.e. "Green Plug"). So far ABB has delivered around 50 per cent of the existing fast chargers in Norway excluding the separate Tesla super chargers (ABB, 2015a). Therefore, the customers of ABB in the EV segments are charging stations nationwide in Norway.

Regarding the smart house and building construction, in order to become fully incorporated into the power supply network, buildings have to be furnished with meters in order to collect precise data of electricity consumption and the building network management. The end user in this case is either the constructing company, the local government's house management organization or individual households.

As a leading industrial service-centred company DNVGL's main customers are firms in the industry rather than public consumers. However, DNVGL does offer training courses to the

[5] Grønn Kontakt is a national operator of charging stations supplying charging service to all types of electrical cars. The company was established in 2009 and is currently owned by 23 power and grid companies from all over Norway. The owners include Statkraft, BKK, Innovation and R & D AS (Agder Energi) etc.

general public for who wants to get technical licenses or learn professional knowledge about some specific issues in the energy sector.

Therefore, in the energy change trend, DNVGL works closely with government not only by investigating the regulation, but also by creating the standards and pushing them to all levels of the government. The authority DNVGL has been granted to issue certification and assurance to its customer due to its ownership of high standard technology and knowhow, as well as by cooperating with the government fund. In all three segments of the energy value chain, DNVGL's main customers are all the players in the energy sector. These include but are not limited to suppliers in the energy value network such as ABB, the utilities and operation firms like Statkraft and Statnett, the companies that own and runs charging stations like Fusa Kraftlag SA and Grønn Kontakt, as well as construction firms that accept better energy consumption solutions. Despite of the training services that may be open to private persons, DNVGL does not have business to consumers. This differs with ABB, who has a clear private market segment as well.

DNVGL believes that providing the platform for communication among its relevant customers is their future business model. Although as an industrial consultancy company, DNVGL has already provided valuable information to all players in the market by publishing and sharing policy research, technical codes, and industrial standard openly.

The above analysis shows that ABB's customer segments are limited to the customers across the electrification value chains that buy physical products from ABB: the firms that produce and transfer power, and firms or public consumers that consume power. Thus, ABB needs to rely on the customer's needs, and the production yield will be influenced by the fluctuation of the power market demand. On the contrary, DNVGL does not sell physical products, but sells its customers consultancy services on industrial policies and knowhow, technology solutions and its authority to issuing certification and assurance. Instead of being influenced by demand like ABB, DNVGL tends to lead the market demand by influencing customers with cutting edge regulations and specific services. The relationship between DNVGL and its customers is less tight but is more like a partnership (Table 7).

Table 7 Customer interface analysis

Pillar 2	BM Building Blocks	ABB	DNVGL
Customer Interface	Customer Segments	• Firms in the renewable electrification value chain Power generation, transmission and consumption. The type of firms include R&D institute, EPC, agency and direct end user—utilities • Public consumer	• All the firms in the energy sector The firms in all segments in the electrification value chain: generation, transmission and consumption, and equipment &service suppliers like ABB • Government
	Channels	Through direct business connections. Direct sale, framework agreement, or public bidding	Through direct business, industrial organization, R&D institute, or forming business partnership
	Customer Relationships	Tight and bonded Technology innovation, production yield, value creation and business model all are led and influenced by customers	Partnership More free of innovating its business model in order to influence customer and lead the needs on the market

4.4 Infrastructure management

The infrastructure describes the firm's organization for value creation realization. Both ABB and DNVGL managers believe that the capabilities for technology innovation are their core competence to create new business models and capture the value during this energy system change. In the annual report, ABB plans to drive business growth more organic by innovating business models more closely with ABB's core competencies (ABB, 2014).

ABB is the technology leader of many products in the energy sector. For example the HVDC technology helped ABB win more than 1000 projects worldwide, the project NordLink from Statnett won by ABB Norway is another example to show ABB's capability to efficiently use of renewables and bring clean power to millions of people and support the energy policies of Germany and Norway. The HVDC technology is pioneered by ABB. As mentioned earlier,

ABB recently won a $450 million order from Statnett for interconnection converter stations that link both ends of the North Sea Network (NSN) between Norway and the UK. This is the latest example of how ABB uses its core competence, technology, to facilitate critical transmission links and to leverage transmission capacity for cross-nation electricity trading, as well as to enhance energy security and boost renewables.
In addition to the technology innovation, the activities ABB takes to improve the business model is being very close with customer, and adjusting business model according to the customer's BMI. For example, Norway encourages the renewable utilities; ABB cooperates with the new renewable utilities and quickly develops the market and builds up customer relationships in the renewable segment by signing framework agreements, by forming partnership with utility owners. Though A1 and A2 still think the utilities are incredibly traditional in Norway and dislike change, they are actually running more and more projects that involve producing electricity from more diversified renewable power and upgrading the energy system due to energy efficiency demand in the energy change trend.

DNVGL never stops creating new ideas of how they deliver their services. Apart from the knowledge and capabilities of technology development, the authority to issue certification and assurance is another strong competence of DNVGL. In the energy sector, licenses and assurances are required in order to operate in the market.
B2 explained that DNVGL uses nine building blocks from Osterwalder and Pigneur (2010) to ask itself for each element: Can we do it differently? Will it still be needed in the future? Will there be competitors who can deliver it in a different way? Whilst self-questioning, B2 said that they have had a growing attention to looking at what is the nature of their services and how they create value. They have questioned themselves about what partners they are depending on, what competences, resources and value propositions they have. For example, B2 explained that a new project team was founded and implemented in early April 2015, and she is involved in this pilot team for the feasibility research on climate change and business model generation based on the firm's knowledge.
B2 furthermore mentioned that the culture in BM is hard to change. Like the Figure 5 illustrates, culture is connected with the other elements of BM, changing the culture means changing everything else of the basic business model and the value creation logic of the firm.
It might not need to change if the customer does not change and the nature of the service does not change.

Thus, DNVGL keeps its business in three domains: consultancy, licencing and assurance. However they exploit and extend the competence to all renewable energy possibilities in Norway. This can be described as economy of scale. Since the input of DNVGL is its core competence—knowledge and technology, the more diversified renewable energy industry DNVGL researches, the less cost it spends per unit. Furthermore, the consultancy service is the new business model comparing with assurance and licence; B1 believes that DNVGL plans to be the most professional and inclusive industrial consultancy company worldwide. Like Mckinsey in management and strategy consultancy service, DNVGL targets to be or rather stay the number one of the industrial consultancy service suppliers on renewable energy and climate change. DNVGL sees their future business model as being a mediation of the value network for its inter-client communication. Additionally, when it comes to the industrial research or technology development, DNVGL has many projects cooperating with universities or institutes in Norway such as University of Oslo and NTNU.

The table 8 below summarises and compares two company's infrastructure management in BMI in the energy change:

Table 8 Infrastructure management analysis

Pillar 3	BM Building Blocks	ABB	DNVGL
Infrastructure Management	Key Resources	Technology and knowhow	Technology and knowhow
	Key Activities	Be close with end user, pioneer in technology, but innovate business model and develop technology to adapt to end user's demands and business model change	Pioneer in BMI and value creation expand to all kinds of renewable energy and energy efficiency as a top industrial consultancy company
	Key Partnerships	Project cooperation with universities. Framework agreements with main end-user Statnett and Statkraft etc.	Research partnerships with universities in Norway, working with government on policy and standards creation

4.5 Financial aspects

The financial aspects include revenue and cost structure, which means through what streams the firm creates value and what are the monetary consequences of creating value.

As mentioned in the theory, the value creation logic of a product-based firm like ABB is mainly based on the Porter's value chain (Porter, 1985). In 2014, ABB Norway achieved sales revenue of 10.7 billion. The revenue stream based on selling products to the end-user in detail is that; after the standard contract is signed between ABB and the end user, normally the payment of a project occurs in three down payments: 30% at contract signing, 65% after delivery and during installation, and 5% function as a guarantee and is kept in a deposit until guarantee period is over.

Meanwhile, as a pioneer in technology investment and development, ABB also offer customers professional consultancy services in order to solve specific problems. For example, offering engineering design or pure service contract that includes regular checks and tests. Thus, ABB's value creation logic also includes value shop. And normally, this kind of contract is signed and paid per year in advance of the service being delivered.

ABB's cost structure of value delivery by selling equipment is presented below (Figure 15) and is divided into three parts in the process: before sales, production and after sales.

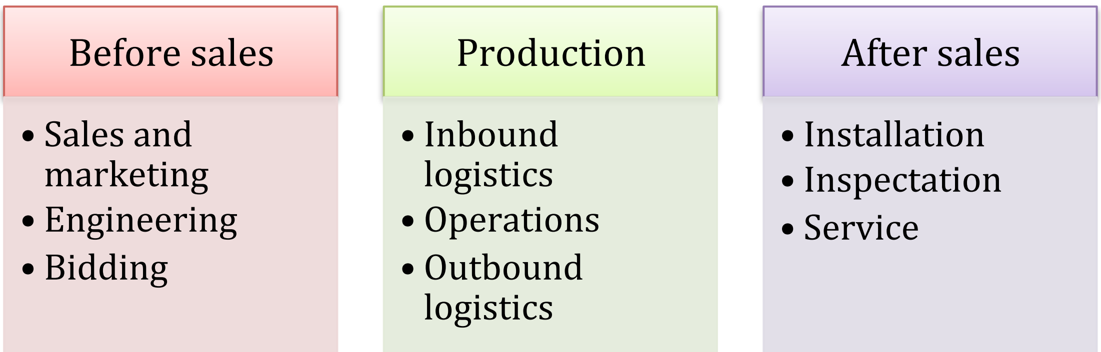

Figure 15 ABB's product-based cost structure in realizing the revenue stream

Due to the value creation logic comprising value shop and value network as a service centred firm, DNVGL's revenue stream is much more diversified compared to ABB. The means of making money include giving training courses to people or to firms on different energy topics for new knowledge or for issuing certification or licenses; offering engineering service includes designing, consulting, and testing; issuing licenses, assurance, and certification; and giving policy consultancy and initiating standards etc. Normally the engineering services are realized by signing a contract and this will be fully paid after the service is delivered, for the authorised issuing service which include the licences, assurance, and certification, the fee has to be paid in advance during the service application session from the customer side. This is the same as the policy for consultancy services and the trainings.

Furthermore, B2 suggest that DNVGL can think more fundamentally about the revenue model, for example, B1 and B2 both shared their new business model ideas such as a network and mediation for all the customers and charge them a membership fee instead of selling hours.

To conclude this part of analysis, table 9 collects the features of both firms' financial aspects:

Table 9 Financial aspects analysis

Pillar 4	BM Building Blocks	ABB	DNVGL
Financial Aspects	Revenue Streams	Mainly by selling products and signing equipment contract; Or offering pure service by signing service contract	Mainly by selling man hours for engineering; Selling authorization services through issuing license and assurance; In the future: membership fee
	Cost Structure	Mainly includes man hours and cost of all the activities, raw materials and logistic before sales, during production and after sales	Mainly man hours

5 Discussion and conclusion

This study clearly shows that the changes in the energy sector are leading the BMI in the firms affected. Interestingly, the author finds that the two suppliers that have been studied here show different approaches to the challenge.

Technology as a drive for business model innovation and as firm's core competence

Both companies are actively focusing on developing their business model to best suit their technology and to meet the challenges made by the dynamic industry. Maybe this is one of the reasons why they are both leaders in their field. The resulting analysis shows that both ABB and DNVGL consider technology as its core competence and they both show the needs to focus more on technology innovation regarding energy and climate change, strengthening customer relationship, creating new services and products.

Teece (2010) suggests that the technological innovation needs BMI in order to create value. Chesbrough (2007) explains that the technology itself does not require BMI, but the technology commercialization demands a profoundly novel value proposition and revenue model compared to the current way of doing business. In the later research, Chesbrough (2010) strengthens that the same technology taken to market through two different business models may yield two different economic outcomes. A mediocre technology pursued within a good business model may be more valuable than a good technology exploited via a mediocre business model, thus, it is why BMI is very important for new technology commercialization. This analysis shows that both firms are very sensitive to the regulation and technology. In order to react to the energy change, developing technology is the basis of leading the BMI to keep their competence on the market, or even jump ahead of the curve to lead the market demand and influence the government regulations as DNVGL does. How the firm creates proper value proposition to commercialize technology is the key to their success.

However, it is also observed that ABB and DNVGL are both technology pioneers in their relative fields in the energy business, they do not just develop technology according to change, they somehow lead the change and enact the market by their technology competence. For example, the HVDC and smart grid technology from ABB lead in the power transfer sector, and DNVGL uses their certification and standard authority to influence the regulation and market demand. The technology or authority as offering from both ABB and DNVGL are the core competence which brings them customers and contracts due to limited substitution /competitors on the market. Thus, their offering is more important than other elements such as customer interface, infrastructure management, and financial aspects in the business model. It is maybe more important than the BMI as well. After all, the technology makes them stand out in the energy market, and most utility managers in the energy sector are focused very much on technology and the reduction of production costs through economies of scale (Richter, 2013). Furthermore, it would have been enriching for the analysis to look at how the smaller suppliers, and those who are not succeeding, are approaching these issues.

Business model innovation on basis of firm's culture and cognition

Existing literature has contradictory opinions on the BMI. One suggests that the BMI is a response either to exogenous technological and regulatory change (e.g., (Amit and Zott, 2001); (Teece, 2010)) or to the dynamic context change (e.g., (Chesbrough, 2010)); another opinion is that the BMI can be applied proactively in the absence of exogenous changes through processes of procreative cognition by firm (e.g., Martins et al. (2015)).

This study can hardly agree on any side since the business cannot run in a vacuum, but in a dynamic context where the BMI is applied. Therefore, the research on BMI should consider both the dynamic context and the inter-organizational cognition.

Chesbrough (2010) considers the firm's cognition as a barrier of BMI, as how the firms see themselves creating value and capturing value can limit their innovative capacity. The success of proven business models strongly influence the information that consequently gets routed into or filtered out of corporate decision processes. This so called 'dominant logic' aids the firm in assessing what information is important, and it will pursue information that fits with this logic and avoid that which conflicts with it (Chesbrough, 2010). However, the firm's cognition is indeed the basis of the BMI. Linking it to the business model configuration theory by Foss and Saebi (2015), the culture as one out of the five elements (Figure 5) is interrelated to the rest of business model elements, and the firms' culture is the most important factor that influences the firm's cognition. In fact, both the culture and firm's cognition are dominant factors of the new value proposition or BMI, and they are the coordinate that measures the position of the firm in the value network. As strengthened by A1 and B2 in the interview, the firm's culture is the core value of their business model, and a domain factor that influences their BMI. They both agree that during this incremental change, no disruptive conversion should happen in the market and to their customers. Thus they should stay on their current value creation logic and not deviate; especially since, according to the interviewees, the electricity industry is very traditional and both ABB, and DNVGL are well-known market leaders and technology pioneers. Furthermore, in order to avoid being blind by their cognition, they both have strong departments as information sensors that collect and analyse market information, government regulation, and technology development. After all, to know what to do, what not to do, what to try, and what they should never try is extremely important cognition that can lower the risk in the firm's BMI and help the company run on the track that is based on firm's culture and core value.

The comparison of the two firms showed that ABB's value creation logic is mainly based on the value chain as a product-based firm. Although it also offers pure service, a service contract is often added after the product contracts are signed. This research seized ABB's value creation logic shift from value chain to value shop due to the energy change that requires its highly professional capabilities to solve specific problems of the end users. However, it is hard to shift to value network because ABB is still and will stay a product-based firm. On the contrary, as a service-centred firm, the BMI leads DNVGL's business creation logic when expanding from value shop to value network. This is achieved through a diversified solution to the energy market that is required by upgrading the energy system. Many prior studies have shown that product-based firms generally struggle to make the shift towards service-centred (e.g. (Gebauer et al., 2005, Ulaga and Reinartz, 2011)).
Foss and Saebi (2015) ask the question of how the firm's often product-based organizational structures, capabilities, and culture can influence a firm's BMI. They also point out that these important organizational aspects of business models and the innovation thereof have so far been missing from the literature. The author links its reason back to the firm's culture and cognition, as well as to the theory of the economies of scale.

The findings of this study indicate that technology is not only the dominant factor of the dynamic context that stimulates the BMI, but also the core competence of the firm that lead the BMI. The success of technology commercialization is based on a good value proposition and BMI. However if the technology is unique, the offering as an outstanding element of business model may lighten the importance of BMI, or will dominate the BMI. Except the technology factor, the BMI differs based on the firm's culture and cognition. A different degree of flexibility in the extent of implementing BMI between product-based firm and service-centred firm is due to firm's value creation difference, and essentially due to the firm's culture and cognition difference.

This study proved that two perspectives—the technology perspective and the cognitive perspective—are both needed to apply BMI, since a firm's business is not in a vacuum, the dynamic change (e.g. (Kijl et al., 2005)) and organizational cognition (e.g. (Aspara et al., 2013)) both affect the business model and its innovation.

Moreover, two implications emerge from the analysis and conclusions in this research.
Firstly, this research has several practical implications for business development and strategy professionals focusing on BMI in the renewable energy market. The value propositions and the different perspectives on BMI, from the leading product- and service-based suppliers, is a good example for managers to learn and practice BMI. The in-depth study on the Norwegian energy regulation and environment, as well as the segment analysing the energy sector prepare the knowledge ground for implementation by managers in the Norwegian energy value network.
Secondly, this exploratory research has several implications for academics. It provides groundwork for researchers to continue deeper analysis of the BMI in the Norwegian energy sector. The methodology that integrated dynamic business model elements and the business model elements to analysis the firm's BMI is practical and logical for future similar study. The results indicate that the BMI in a product-based firm is more likely to be influenced by the end user, but the service-centred firm is more likely to influence the end user. It would be interesting to conduct more interviews across a number of suppliers who vary in size, resources and brand popularity to determine how the BMI will be impacted by these factors, and to highlight the main differences between product-based firms and service-centred firms in applying BMI.

Though this research is designed with full consideration of reliability and validity, due to the limited timespan of the research, there are some limitations that need to be pointed out:
First of all, the findings from this study may be argued that they providing limited basis for scientific generalization due to the quantity of the units of analysis (Yin, 2009); Secondly, the research topic limits the author to only a few people within the organizations who can provide in-depth insights, although the study will achieve higher validity by having more interviewees. Finally, during the time of conducting the research and while writing this thesis, many innovations are still on going, therefore the viable measurements may not be thorough and completed.

In conclusion, this research is resonant with previous literature. This explorative study contributes with essential groundwork for future research on this very interesting and important topic in times of change in the energy sector.

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Appendix 1: Interview Questions

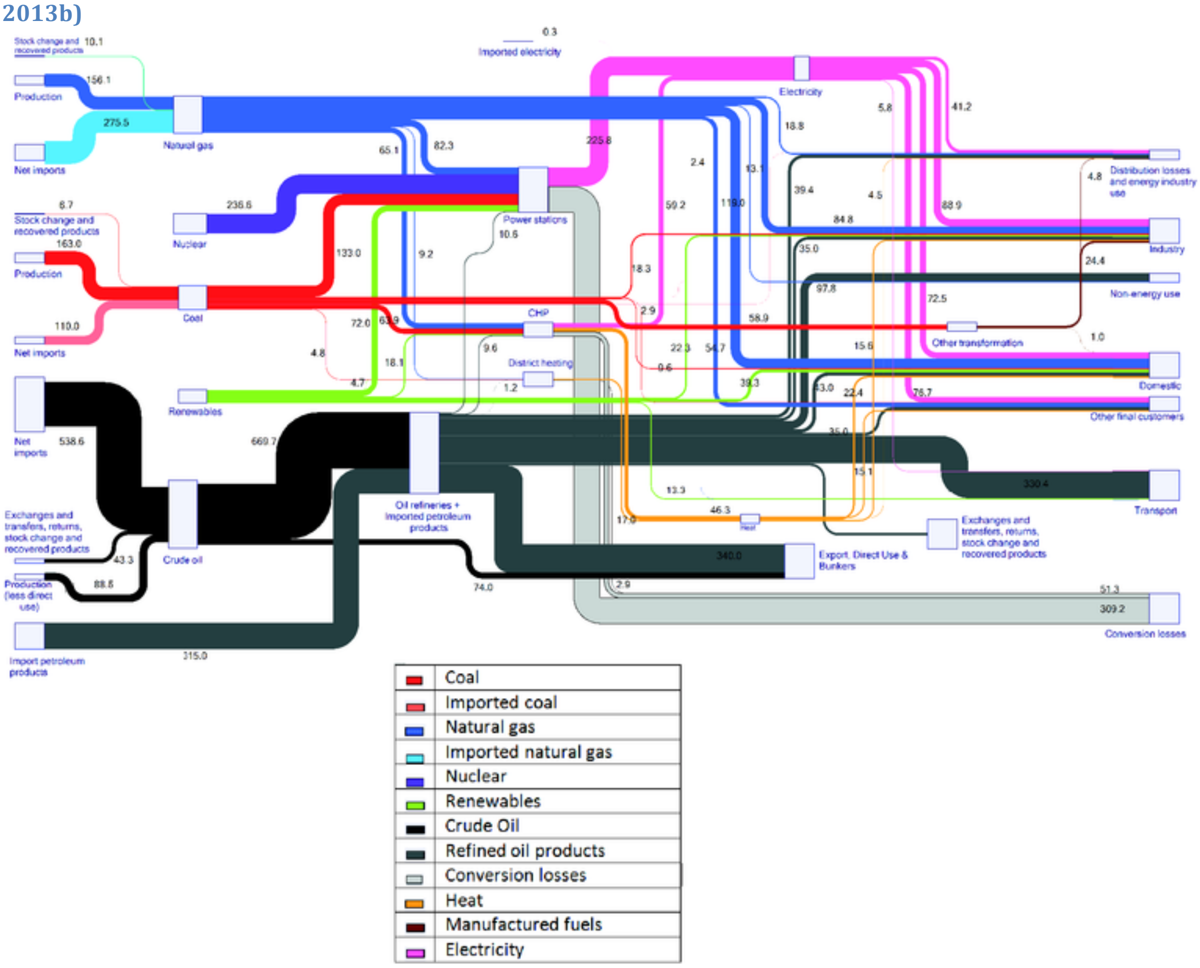
Table 10 Analysis categories and interview questions

No.	Categories	Semi-structured Interview questions
1	Dynamic Context	What is the current dynamic context? What actions did ** take when affected by the change? Is the business actively following this big trend of new energy/clean energy? What is the regulation in the energy sector that will influence the current business model? What are the new technologies in the energy industry? What is the focus of ** on technological issues? What is ** view on the low carbon energy and the climate change? Are there any actions being taken right now?
2	Offering	What is the current value creation logic of the company and in your department? Does ** want to become a more pure energy service supplier instead of a product-based supplier? To what specific energy industry are your company want to expand and what will be the value proposition?
3	Customer interface	What are the customer segments ** targeting? What will change in BMI? Through what channels does ** interact with customers: Partnership, agency or else? How is the relationship between ** and customer?
4	Infrastructure management	In your opinion, what is the core competence of **? What are the activities the company take to realize the profit? What are all the types of business model relate with energy industry?
5	Financial Aspects	What is the cost structure and allocation in the value delivery? What are all the revenue streams in the energy related business?

(Here '**' represent the analysis unit – company name)

Appendix 2: Summaries the overall picture of the energy system in the EU

Figure 16 Summaries the overall picture of the energy system in the EU (European Environment Agency, 2013b)



Appendix 3: Summary of energy support schemes in the Norwegian energy sector

European Environment Agency

Country profile –Norway

Country: Norway												
Support schemes	Electricity and heat production			Consumption				Transport		Supply and others		
	RES	Fossil	Nuclear	RES	Fossil	Electricity	Heat	Biofuels	Fossil	RES	Fossil	El.\heat
1. Direct subsidies												
Direct on-budget subsidies		13, 12,										
Feed-in tariffs												
Feed-in premiums												
Adjustment Aids												
Inherited liabilities												
Induced transfers												
Others												
2. Fiscal measures												
Energy Tax Allowance												
Energy Tax Exemptions					15, 14, 11, 7, 4, 3, 2				8, 6, 5			
Other Tax Deductions												
Earmarked refunds of taxes												
3. Transfer of risk to government												
Adjustment Aids												
Inherited liabilities												
Others												
4. Other financial measures												
Adjustment Aids												
Other Tax Deductions												
Others												
5. Non-fiscal measures												
Quota obligations	1									1		
Priority Grid Access												
Others												

No.	Datasource	Description
1	RES-LEGAL	Quota system - The Electricity Certificates Act obliges electricity suppliers and certain electricity consumers to annually acquire renewable energy certificates in due proportion to their electricity sales and their consumption by a set date. Furthermore, the act stipulates the conditions under which owners of renewable energy generation plants may acquire electricity certificates.
2	OECDTADFFSS	NOx-Tax Exemption for Industry. A tax on emissions of NOx was introduced in 2007. An exemption from this tax is granted to those industrial users that participate in the government programme committing them to achieving NOx-reduction targets.
3	OECDTADFFSS	CO2-Tax Exemption for Fisheries. Norway provides the fisheries sector with an exemption from the CO2 tax that is normally levied on sales of mineral oil.
4	OECDTADFFSS	NOx-Tax Exemption for Fisheries. A tax on emissions of NOx was introduced in 2007. An exemption from this tax is granted to those industrial users that participate in the government programme committing them to achieving NOx-reduction targets.
5	OECDTADFFSS	Lower Tax Rate on Diesel Compared to Petrol. When it comes to the tax levied on road users, Norway levies a lower tax rate on diesel in comparison to petrol. According to the national budget, that constitutes a tax expenditure.
6	OECDTADFFSS	NOx-Tax Exemption for Domestic Shipping. A tax on emissions of NOx was introduced in 2007. An exemption from this tax is granted to those industrial users that participate in the government programme

		committing them to achieving NOx-reduction targets.
7	OECDTADFFSS	Concessions on Basic Tax on Mineral Oil. A basic tax on mineral oil was introduced in 2000 in order to prevent overconsumption of heating oil in light of the newly introduced higher tax rates on consumption of electricity. The general tax rate on mineral oil has been increasing over time and it now corresponds to the general tax rate on consumption of electricity (including a levy on the electricity distribution tariffs). The wood processing and pigment industries are granted a lower tax rate on mineral oil while the herring meal and fishmeal industries are exempted from this tax.
8	OECDTADFFSS	CO_2-Tax Exemption for Natural Gas and LPG Used in Shipping.
9	OECDTADFFSS	NPD Seismic Investigations. The government of Norway provides funding for the research activities of the Norwegian Petroleum Directorate (NPD). The NPD concentrates on acquiring knowledge connected to the Norwegian continental shelf, which is then effectively used by the oil and gas industry (access to the NPD resources is granted after a small lump-sum payment).
10	OECDTADFFSS	Petroleum R&D Funding. The Research Council of Norway offers financial support for petroleum research and development activities through funding provided by the Ministry of Petroleum and Energy. In 2011, about 10% of the Council's budget of over NOK 7 billion was devoted to research related to petroleum and energy.
11	OECDTADFFSS	CO_2-Tax Exemption for Natural Gas Used in Greenhouses.
12	OECDTADFFSS	Petroleum R&D Funding. The Research Council of Norway offers financial support for petroleum research and development activities through funding provided by the Ministry of Petroleum and Energy. Part of the funds is devoted to research related to natural gas.
13	OECDTADFFSS	NPD Seismic Investigations. The government of Norway provides funding for the research activities of the Norwegian Petroleum Directorate (NPD). Part of the funds is devoted to research related to natural gas.
14	OECDTADFFSS	CO_2 Tax Exemption for Natural Gas Used by Industries Encompassed by EU ETS. A CO_2 tax on natural gas (CO_2-avgift på naturgass) was introduced on 1 September 2010. Some industries that are encompassed by EU ETS, however, are exempted from CO_2-tax payments. No data available.
15	OECDTADFFSS	CO_2 Tax Exemption for Natural Gas Used by Industries Outside EU ETS.A CO_2 tax on natural gas (CO_2-avgift på naturgass) was introduced on 1 September 2010. Some industries that are not encompassed by EU ETS, however, are exempted from CO_2-tax payments. No data available.

Figure 17 Summary of energy support schemes in the Norwegian energy sector (European Environment Agency, 2013a)